A Casebook for Management Information Systems

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A Casebook for Management Information Systems

Second Edition

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TO OUR CHILDREN

Contents

Preface

This casebook is intended for use in a variety of courses which deal with computer-based information systems. It has been written specifically to accompany the McGraw-Hill texts The Analysis, Design, and Implementation of Information Systems (second edition) and Information Systems Concepts for Management by Henry C. Lucas, Jr. The cases have been used successfully in courses in systems analysis and design for majors in the systems field and for courses primarily designed as surveys for students majoring in fields like finance and accounting.

This second edition of the casebook features a large number of new cases combined with the most popular cases from the first edition. We have attempted to cover many of the same issues raised in the first edition, but with new cases. We have updated and modernized the Hollister case from the original edition as well.

The Hannaford A and B cases deal with the problems of planning and managing the analysis and selection of information systems projects. The A case describes the background of Hannaford Brothers while the B case presents the information systems problem faced by the company.

The United Farm Workers Organizing Committee and Robert F. Kennedy Memorial Health Plan A case asks the student to prepare a proposal demonstrating his or her approach to the design of an information system.

The Carver Consolidated Products case presents an example of an existing computer-based information system for operational control and transactions processing. The existing system has some serious shortcomings which can be remedied through the application of modern systems design techniques and computer technology. The L. G. Wynant case is closely related; it presents a situation in which the student can design a straightforward system to help solve the firm's information processing problems.

The Hollister case relates the trials of a firm attempting to implement a factory floor control system for manufacturing. The firm has had a number of problems and now is trying to experiment with a new approach.

The Dyco A and B cases present a popular and important use of computer-based systems. The firm has developed a planning model supported with external data and a model of the United States economy.

Southwest Lumber presents issues related to systems analysis and design and the management of the information systems function. Domtar discusses related problems, particularly concerning the structure of information processing services.

The Guaranteed Student Loan case illustrates how the poor processing of information and the lack of a control system can threaten the very existence of an organization. Pacific Cooperative is a company faced with a number of problems with its computer department. The student acts as a consultant to the Coop and develops recommendations to help improve its information processing procedures.

The Realtronics case illustrates the problems of an entrepreneur who must choose from various alternatives to obtain information processing and computer support. The computer is critical to the success of the owner's firm and there are significant problems with it at Realtronics.

The Corporate HRS and Privacy case at Cummins Engine describes some of the significant social problems encountered when developing systems. A personnel system has created major concerns over the privacy rights of individuals about whom data are stored in the system.

The Microfiche Index System presents the student with a well-specified information processing problem and asks for a recommended solution. The problem is clear, but there are several competing ways to solve it and the exercise raises a number of important issues.

Bay Markets illustrates some of the difficulties of managing information processing activities. The relationship between the senior management of the company and the manager of information processing is an important one. Project Paradise concludes the book on the same theme; how does one efficiently manage computer operations and introduce significant changes into the computer organization?

Henry C. Lucas, Jr.

Cyrus F. Gibson

A Casebook for Management Information Systems

Hannaford Brothers Co. (A)

David P. Norton*

The Grocery Industry

The retail food industry is one of the nation's most competitive arenas of business activity. Chain store sales have increased 82% in the last ten years as a result of growth in population, increased expenditures on convenience and gourmet foods, and a shift of sales from small independent stores to chain store outlets. Many of the largest and oldest chains, however, have failed to keep pace with the industry growth rate. The commanding positions held by the old dominant forces in New England food retailing, A&P and First National, have been successfully challenged by groups of small aggressive local and regional chains.

Chain stores, as well as many other merchandising activities, require relatively modest capital investments. Thus, many small groups have been afforded easy access to the business and have competed by catering to the local conditions of a particular city or small region. These stores can react quickly and often are not burdened with more costly union labor nor, because of their recent vintage and familiarity with local conditions, are they hampered by long-term leases on smaller stores. Although few of these companies have expanded successfully beyond a very small area, they have competed aggressively for their share of market. Chain Store Age, the industry's major trade journal, publishes annually an impressive list of small chains that were insignificant only ten years ago.

*This case was prepared by David P. Norton, Research Assistant, under the supervision of Associate Professors F. Warren McFarlan and Richard L. Nolan.

With shifting urban housing patterns and increased use of cars, the large shopping center and supermarket have come to dominate the food scene. Stores have been getting bigger to both serve the larger, mobile consumer pockets and provide space for an expanding array of foods, created by new technology and demanded by increased affluence. Today's modern stores offer not only dry groceries and meat but also huge frozen goods displays, "deli" centers, fresh fish centers, "in-store" bakeries, gourmet sections, and ethnic food areas. A large supermarket of ten to fifteen years ago had a weekly volume of $20,000-$30,000 compared to $80,000-$150,000 of some of the huge stores of today with 6,000-8,000 items on the shelves. Although the basic consumer is the same, economic, sociological and demographic conditions have drastically altered demand patterns of this industry. The buyer, although in a classic sense an industry captive, has very limited store loyalty due to intense competition. In addition, consumer preferences for "purchasing packages" have caused shifting store images. Food stamps, coupons, specials, games, continuity merchandise programs, "quality," and "price" all compete for the changing consumer affections. The phenomenal success of "Mini-Pricing" and the agonizing decision of A&P to give stamps are two illustrations of the potency of marketing strategies.

Except for meat and produce, most chain suppliers are large national food processing companies. Substantial advertising campaigns, resulting in brand identification, necessitate stocking of many items and various anti-trust legislation greatly restricts the ability of manufacturers to offer (and stores to accept) quantity pricing discounts. Chain stores have responded with a minimal amount of backward integration and substantial use of "private labels" to circumvent these regulations. Many of these store brands have gained an acceptance of their own; the extensive private label array of A&P would certainly fall in this category. Private label merchandise, however, has met some consumer resistance, particularly "A&P," and sometimes generates less profit than the higher price branded merchanidise. Most chains have not made major investments in packing facilities, preferring to have their merchandise packed under contract. Most stores are also leased although some chains lease facilities from related real estate ventures.

Major Decision-Making Variables

The grocery industry is a retail merchandising business. Although some manufacturing is performed, the industry mainly performs the function of providing retail outlets for the products of a large number of suppliers. Thus, the success of a company operating in this environment will be determined largely by its ability to recognize the tastes and buying patterns of the consumers and to satisfy them efficiently. Conventional approaches to the merchandising task involve four major classes of decisions.

This first class involves the selection of the "right" product for the target market. In the grocery industry, product strategies involve selecting the breadth and mix of the product line to be offered to the consumer. A typical problem would be the recognition of unique diets in a particular ethnic neighborhood (e.g., Italian or Jewish) and adjusting the product line accordingly. The selection of a line of private labels to complement the national brands is another typical decision.

The second class of decisions refers to the selection of the appropriate place and process for getting the product to the customer. A key decision would be the selection of sites for outlets as well as the physical design of the store itself. On a lesser scale, the placement of particular products within the store is another decision which falls within the class.

The pricing of the product line is key, not only to the generation of sales, but to the determination of profits as well. Pricing strategies in the grocery industry are fundamental to the image which the company wishes to convey; be it convenience, quality, or economy. Pricing decisions are closely tuned to the actions of competitors. The selection of "price leaders" is typical of such decisions.

Promotion is the process of communicating information about the above items to potential customers. Advertising through mass media is a prime variable. Newspapers have traditionally played a dominant role in the grocery industry. "Trading stamps" have been used extensively in recent years to promote sales although the percentage of supermarkets using this device has been declining. Private mailings are used extensively to communicate with a limited audience. The use of in-store

displays is another promotional device which has proven effective in the grocery industry.

While the merchandising portion of the task generally dominates discussion in any retail industry, the operations required to support the merchandising effort are also important determinants of success. The operations can be thought of as the efficiency with which the merchandising effort is conducted. The operating efficiency would be reflected in the costs which are paid for goods purchased as well as manufactured. It would also be reflected in the cost of bringing the goods supplied to the customer. This would include methods of ordering, transporting and storing merchandise. A final (and unmeasurable) effect of operating efficiency is the opportunity cost associated with lost sales and profits. Improperly stocked shelves or stale perishables can cause losses in profits which will never appear on the financial statement, yet are nonetheless real.

Thus, it is both merchandising and operations which will determine the ultimate success or failure of an entrant in the grocery industry. The degree of success, as judged by the stockholders, will be evaluated in light of the investment required. Exhibit 1 relates the decision-making variables discussed above to the criterion used by the stockholder.

HANNAFORD BROTHERS CO.

Hannaford Brothers Company was founded in 1883 as a small produce outlet in Portland, Maine. In the intervening ninety years, Hannaford has grown into a major regional enterprise, supplying groceries and management know-how to wholesale and retail customers in Maine, New Hampshire and Vermont. Historically a grocery wholesaler supplying small independents, it has only been in recent years that Hannaford has played an active role in retail grocery merchandising. It is helpful to view the process by which Hannaford evolved to its present mode of operation.

The Early Years

Formed by the Hannaford brothers in 1883 to provide an outlet for produce grown by their family, the company was incorporated in 1902 and by 1918 had grown into one of the leading wholesalers of fruit and produce in northern

New England. "Hannaford's subsequent entry into the grocery business," states Walter Whittier,[1] Hannaford's chairman, "was influenced by the impact of the development of chain stores. For generations Portland has been an important wholesale distributing center. In 1900 there were 20 wholesale grocery firms...most of them small. With the intensification of competition that followed the development of chain stores, especially A&P, many of these companies were liquidated or consolidated with other local enterprise."

Much of Hannaford's growth during this period was a fallout from this process. In 1927 Hannaford formed a grocery department with several key personnel from an old-time grocery wholesaler that had liquidated. The department was considerably expanded in 1939 when Hannaford purchased the wholesale grocer who sponsored the Red & White stores in the State of Maine. To enable these small independent retailers to compete effectively with the large chains, Hannaford provided a range of services. Qualified personnel were assigned to activities such as store layout, advertising, promotion and retail accounting. Hannaford further expanded its product line in 1945 when, as an outgrowth of a nonprofit wartime meat slaughtering operation, it established a wholesale meat department.

The fifties saw Hannaford, with the benefit of a merger and a resultant increase in working capital, emphasize the development of larger locally owned supermarkets in northern and eastern Maine. These newly developed stores were largely, but not exclusively, opened under the Red & White marque. Stress was laid on selecting locations through careful research by company personnel and consultants. Many of the new or remodeled stores were leased by Hannaford and later subleased to individual operators... a practice which was to take on increased importance in the future. During this period of expansion, Hannaford continued to emphasize the development of services which would enable the small independent supermarket operators to compete with the large corporate chains.

[1]Walter Whittier, "History of Hannaford Bros. Co." in <u>The Hannaford Family--Moving Together to Meet the Times</u>, a company brochure.

Turning Point

As a result of their growth and management performance, Hannaford was able to obtain an unsecured loan of $1,000,000 in 1958 from the Prudential Insurance Company. With this improved financial position, Hannaford constructed a modern new warehouse and headquarters in South Portland. In addition a subsidiary, Hanbro, Inc., was organized to aid in the financing of supermarkets. Hanbro owned the fixtures to be used in stores on which Hannaford held the prime lease and leased this fixtures to the store operators.

The nature of Hannaford's customers had undergone considerable change in the postwar years. By 1961 they were serving only 126 customers compared with some 1,700 during the prior fifteen years. New business was restricted to Red & White and contract accounts. Whittier described the thinking of that time as follows:

> The future of the company clearly depended upon the ability to develop new supermarkets. The risks of not doing so were brought home when, early in 1961, one of our major customers...the operator of four markets in Portsmouth...sold his business to Star Markets of Boston and this account was lost to Hannaford.

A similar setback in 1962 resulted in a year of no sales growth for Hannaford...the first time that this had occurred in thirty years. The loss stimulated an increased activity in store development and has much to do with the structure of the company at present. The following paragraphs describe Hannaford as it exists today.

THE RETAIL BUSINESS

Retail Outlets

As a result of the concern for store development to create a stable business for the wholesale distribution center, Hannaford placed an increased emphasis on the so-called "51-49" or "equity partnership" concept. Under this concept Hannaford assumed a controlling financial interest in the retail outlet with the local operator assuming minority ownership. Although the first arrangement was

initiated in 1944, the sixties saw a vigorous expansion of these partnerships. In 1960 Hannaford had entered into six equity partnerships along with one wholly owned outlet. These stores accounted for 13.7 per cent of Hannaford's over-all wholesale business. Ten years later there were 57 stores operated on a partnership basis along with two wholly owned outlets, accounting for 62 per cent of the wholesale business. In addition many new supermarkets were developed in locations where Hannaford holds the primary lease but has no interest in the business itself.

An example of Hannaford's commitment to the equity-partner concept occurred in 1965 when they acquired their major retail customer, Sampson Supermarkets, a 31-unit chain with 1965 sales exceeding $25 million. After an initial shakedown period, a 30% minority interest was sold back to the original owners. When asked to comment on the reasoning underlying this resale, Whittier observed:

> First of all, we want the people that are running a store to have something at stake beyond just a job. Secondly, we didn't really have the expertise to operate the retail stores. We wanted to take advantage of what they knew.

Real Estate Development

With Hannaford's increasing involvement in retail store development, it was natural that they should become more deeply involved in the real estate and construction side of the business. In 1968, Hannaford acquired the Callahan Construction Company. This subsidiary is responsible for site selection and development, store construction and remodeling. The objective of the acquisition was to provide a source for real estate development services that understood the company's needs and problems as well as to insure that the charges for these services would be reasonable. A former member of the Sampson Supermarket organization was assigned responsibility for the construction company. A recent incident during the remodeling of a retail outlet highlighted the value of affiliating the real estate functions with the parent organization. One aspect of a remodeling plan called for the movement of the checkout counters by several feet. Noting that the movement seemed somewhat meaningless and would be costly, the head of the construction company brought this to the

store operator's attention. The operator immediately agreed that the move would provide little benefit and the remodeling plan was modified. Whittier observed:

> An outside contractor, no matter how well intentioned, probably never would have asked that question. However, in this case the fellow that runs the construction company was looking out for the best interest of the equity partner. They made the decision about where to locate the checkout counter themselves without feeling the necessity of clearing with the home office. This is just the way we want it.

Management Services

While Hannaford was continuing the development of retail outlets, in effect creating business on which the wholesale distribution center could depend, they were also creating a responsibility for profitable operations at the store level. In order for the retail stores to function profitably, it is essential to provide them, not only an attractive product mix, but a range of services which they need but cannot perform themselves. In addition to the buying, warehousing and delivery of goods to the stores, Hannaford also develops merchandising programs...sales plans, retail pricing, promotions, advertising...for the stores as well as site selection, store layout, financing of store fixtures, accounting systems and personnel recruiting. These services are offered for various fees to any customer of the wholesale distribution center, regardless of whether he is an equity partner. The services are optional, although in most cases, the retail stores could not function without them. The retail outlets, including the equity partners, are not bound to use the services in any way. Whittier described Hannaford's philosophy as follows:

> Our feeling for the last ten years has been that trying to bind these people by legal contracts is just not necessary. If you provide a good quality of service, you don't have much trouble in getting them to stay with you. If you have to make them sign a legal contract, then right off the bat you suspect the service isn't as good as it should be.

Competition

The retail outlets supported by Hannaford merchandise a complete line of grocery, meat, produce, frozen foods and health and beauty aids. These outlets compete for the consumers' dollars with such major chains as A&P and First National as well as with other independents. While the operations of the large chains span much broader geographic territories, they tend to be organized on a regional basis. Hannaford's sales area of northern New England equates with one region of the larger chains...a region which must have its own distribution center and its own merchandising staff. In comparing his operation to that of the corporate chains, Whittier noted that Hannaford's distribution center presently transfers more than $100 million of merchandise to the retail stores annually, a figure he maintains compares quite favorably with the performance of the large chains in that area. Commenting on the job of competing with the giants, Whittier noted:

> We have one newspaper that covers eastern and northern Maine...The Bangor Daily News. We advertise in that paper, as does A&P and First National. However, we have more stores and more retail volume in that area so that we can spend more money for advertising and it is still a smaller percentage of sales (less than 1/2 of 1%). The fact that First National and A&P spend a helluva lot of money on advertising around Boston doesn't help them one iota up here in northern Maine. Our advertising in The Bangor Daily News is much more impressive.

Whittier noted further that Hannaford had done a better job in selecting store location evidenced by the fact that their retail outlets produce a much higher sales volume per square foot of store space than either A&P or First National in that area. On the average Hannaford-supported retailers tend to have larger and "more attractive" stores than the corporate chains. One final factor which weighs heavily in Whittier's assessment of Hannaford's competitive position is the fact that the retail outlets are locally owned and operated.

> One of our largest subsidiaries is the Cottle Stores in central Maine. Mr. Cottle is a partner of ours, but

as far as the public is concerned there is no sign identifying this as a Hannaford store. In South Parrish, the largest store in the area is run by Gordon Smith. It's called Smith's Shop & Save. As far as the public is concerned, it's Gordon Smith's store and everyone around town knows who Gordon is. The public sees a Hannaford truck there but they also see it at the Sampson store (in which we have 70% interest) which is only 150 yards away. Both stores are locally owned and "independent."

THE WHOLESALE BUSINESS

The emphasis on retail store development in the past 15 years has insured a dependable source of business for the wholesale distribution center. Presently, the center supplies the 59 retail outlets in which Hannaford owns controlling interest as well as another 44 outlets in northern New England which are independently owned. While wholesale transfers accounted for only 28 percent of Hannaford's sales in 1970, profits on these transfers amounted to 45 percent of total net income before extraordinary items. The retailer is billed for the "landed cost" (cost to the distribution center) of the merchandise, plus a fee which is determined by the added services. For example, a separate charge is made for delivery which is related to distance. Advertising, retail pricing and sales planning are typical of other services for which a separate charge is made.

The distribution center handles a complete line of meats, fresh fruits and vegetables, groceries, beverages, frozen foods, sea foods, dairy and delicatessen products. While Hannaford's volume is not sufficient to justify its own bakery or dairy, the company is a member of Staff Supermarket Associates, a cooperative buying group made up of 17 or 18 smaller chains, which permits them to distribute a broader range of private label merchandise.

The company estimates that it is the largest grocery wholesaler in northern New England. Whittier attributes a large percentage of the company's success to their ever-increasing involvement in retail store operations.

> We are conscious of providing a good mix to the retailers so that they can attract customers and, in the process, make a better gross profit. The very

> fact that we have equity customers makes us conscious of the need for retail profits. More and more of our earnings have been coming from retail operations and we are very conscious about keeping our charges down so that the retailers can operate profitably.

This philosophy was exemplified by the acquisition in 1967 of Progressive Foods, Inc., a rack-jobber[1] in health and beauty aids (HBA), pets' supplies, etc. Prior to the acquisition, retail HBA sales had not been impressive. One executive noted, "It is very hard for our store managers to find someone in the stores who has the time and ability to arrange the shelves as they should be. The job becomes more and more complicated all the time." Assigning these responsibilities to the rack-jobber has improved performance significantly with both greater sales volume and a broader product line. For example, Hannaford had a private label line of women's hosiery which it attempted, unsuccessfully, to sell through its warehouse. The item was transferred to the rack-jobber and sales increased impressively.

The dependence of the wholesale business on the retail outlets continues to be one of the key elements in the Hannaford operation. Whittier describes this relationship as follows:

> One of the real strengths of our business is that, while we are really a chain store operation, we are set up as a wholesaler. I'm not saying this is based on foresight...it is just the way we grew. As a result we maintain a great many profit centers...the wholesale operation, the retailers, the construction business, the rack-jobber, etc. Further, we have a great many customers who have no obligations or financial commitments to us. They can leave us any time they wish. The fact that we serve these customers and are able to keep them is an indication that our goods and services are really competitive.

[1]A rack-jobber specializes in products of which there are many items with relatively low sales volume, thus making it uneconomical for the larger distribution centers. The jobber is responsible for stocking, displaying and marking the merchandise. He is generally paid on the basis of merchandise sold or delivered.

Exhibit 1
HANNAFORD BROTHERS CO. (A)
Model of the Decision-Making Variables

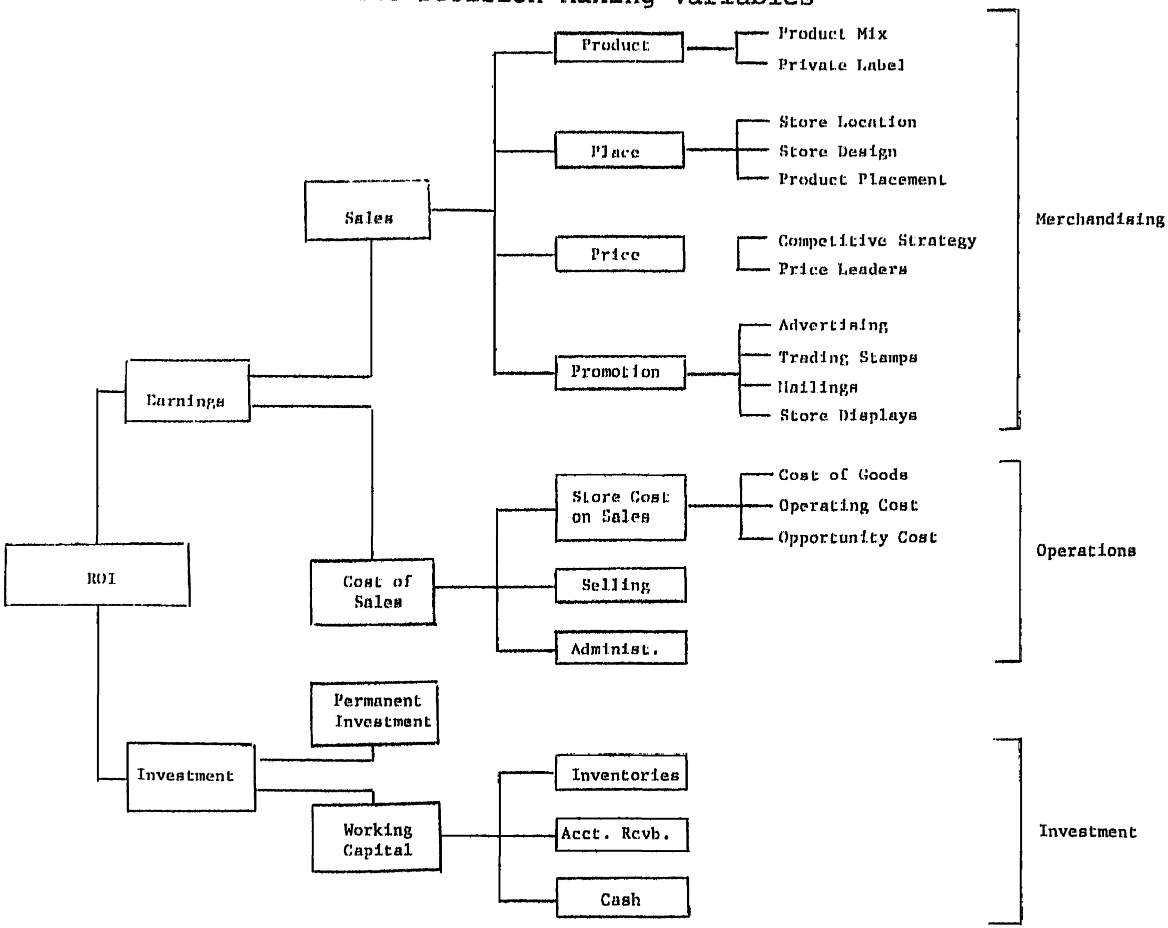


Exhibit 2

HANNAFORD BROTHERS CO. (A)

Statement of Consolidated Earnings

	FISCAL YEAR 1966	1967	1968	1969	1970
	(Amounts in Thousands)				
Revenues:					
Net sales	$64,092	$86,792	$98,170	$106,507	$123,942
Other operating revenue	1,145	1,001	1,022	1,279	1,931
	65,237	87,793	99,192	107,786	125,873
Cost and Expenses:					
Cost of sales	55,476	71,690	80,730	87,652	102,447
Selling, general and administrative expenses	8,508	14,145	16,150	17,800	20,379
Interest, principally on long-term debt	88	439	425	596	644
	64,072	86,274	97,305	106,048	123,470
Earnings before income taxes, minority interest and extraordinary items	1,165	1,519	1,887	1,738	2,403
Provision for income taxes	449	699	838	955	1,196
Earnings before minority interest and extraordinary items	716	820	1,049	783	1,207
Minority interest	149	214	315	220	275
Earnings before extraordinary items	567	606	734	563	932
Extraordinary items	-	-	(110)	82	(88)
Net earnings	$ 567	$ 606	$ 624	$ 645	$ 844
Per share of common stock					
Earnings before extraordinary items	$ .91	$ .97	$ 1.17	$ .89	$ 1.41
Extraordinary items	-	-	(.18)	.13	(.13)
Net earnings	$ .91	$ .97	$ .99	$ 1.02	$ 1.28
Cash dividends	$ .10	$ .12½	$ .15	$ .17½	$ .20

Exhibit 3
HANNAFORD BROTHERS CO. (A)
Consolidated Earnings by Product Line

(Amounts in Thousands)

	1966		1967		1968		1969		1970	
Net sales* and other operating revenue:										
Retail	$30,711	47%	$58,350	66%	$63,358	64%	$ 76,079	71%	$ 89,066	71%
Wholesale**	33,381	51	28,442	33	34,812	35	30,429	28	34,876	28
Other	1,145	2	1,001	1	1,022	1	1,279	1	1,931	1
Total	$65,237	100%	$87,793	100%	$99,192	100%	$107,787	100%	$125,873	100%
Net earnings before extraordinary items and minority interest:										
Retail	$ 305	43%	$ 520	63%	$ 574	55%	$ 323	41%	$ 511	42%
Wholesale	311	43	232	28	387	37	340	43	478	40
Other	100	14	68	9	88	8	120	16	218	18
Total	$ 716	100%	$ 820	100%	$ 1,049	100%	$ 783	100%	$ 1,207	100%
Net earnings before extraordinary items:										
Retail	$ 158	28%	$ 311	51%	$ 284	39%	$ 143	25%	$ 303	33%
Wholesale	311	55	222	37	363	49	287	51	422	45
Other	98	17	73	12	87	12	133	24	207	22
Total	$ 567	100%	$ 606	100%	$ 734	100%	$ 563	100%	$ 932	100%

*Intercompany sales have been eliminated from wholesale operations.

**The primary reason for the decline in wholesale sales and earnings for fiscal 1967 and wholesale sales for fiscal 1969 was the acquisition by Hannaford of wholesale customers.

Exhibit 4

HANNAFORD BROTHERS CO. (A)

Balance Sheets--January 2, 1971
(Amounts in Thousands)

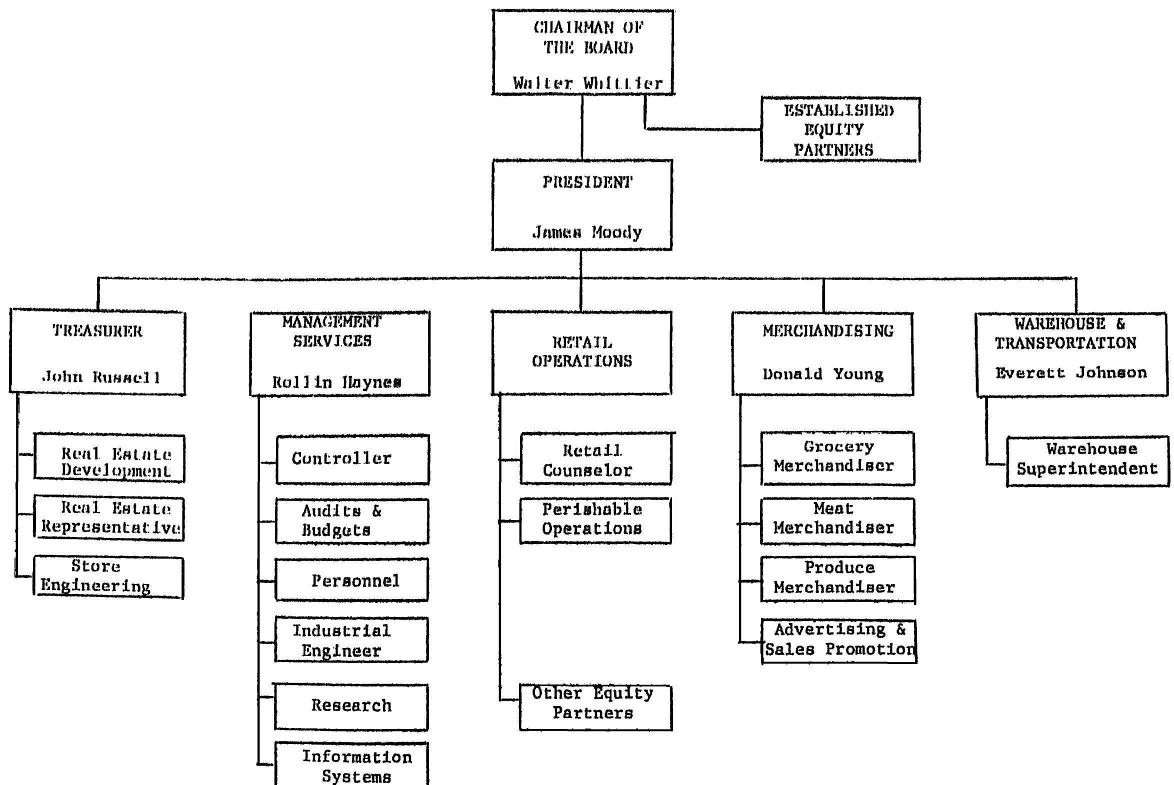
ASSETS	Parent	Consolidated
Current assets:		
Cash	$ 681	$ 2,567
U.S. Treasury bills	248	258
Accounts receivable:		
Trade	705	1,498
Other	-	321
Due from subsidiaries	202	-
Inventories	3,030	6,583
Prepaid expenses	219	571
Total current assets	5,085	11,799
Investments and advances:		
Investment in subsidiaries	3,793	-
Advance to subsidiaries	1,149	-
Total investments and advances	4,942	-
Cash value of life insurance	125	230
Property, plant and equipment, at cost, less accumulated depreciation	526	11,223
Goodwill, at cost	-	200
Other assets:		
Notes and accounts receivable	137	159
Other assets and deferred charges, net of applicable amortization	227	264
Total other assets	364	422
	$11,043	$23,875

LIABILITIES AND STOCKHOLDERS' EQUITY	Parent	Consolidated
Current liabilities:		
Notes payable, banks	$ -	$ 15
Current maturities of long-term debt	105	1,450
Accounts payable - trade	1,706	3,909
Accrued expenses:		
Salaries and wages, including profit sharing and bonuses	258	640
Taxes, other than income taxes	52	258
Interest	10	37
Other	22	162
Income taxes	343	1,046
Total current liabilities	2,497	7,517
Deferred compensation and deferred income taxes	247	572
Long-term debt, excluding current maturities	1,377	6,720
Minority interest in subsidiaries:		
Capital stock	-	448
Retained earnings	-	1,697
Total minority interest in subsidiaries	-	2,145
Stockholders' equity:		
Preferred stock, par value $10 per share Authorized 500,000 shares: issued none	-	-
Common stock, par value $1 per share Authorized 2,000,000 shares: issued 660,960 shares	661	661
Additional paid-in capital	761	761
Retained earnings	5,499	5,499
Total stockholders' equity	6,921	6,921
Contingent liabilities and commitments	$11,043	$23,875

Exhibit 5

HANNAFORD BROTHERS CO. (A)

Corporate Organization Chart



Hannaford Brothers Co. (B)

David P. Norton*

In the spring of 1971, Hannaford obtained the services of a local consulting firm to aid in the preparation of a long-range plan for information systems development. The consultants were requested to review the decision-making process in each of Hannaford's functional areas. From this review a set of potential CBIS applications was to be identified such that a management committee could construct a prioritized list as a basis for the long-term plan. The decisions and potential projects identified by the consultants are described below.

MERCHANDISING

The merchandising organization at Hannaford is responsible for (a) buying grocery, dairy, frozen foods, meat and produce; (b) sales of these products to retailers; (c) preparation of sales-plans for retail stores; and (d) preparation of advertising and promotion programs and pricing levels for retail stores. The consultants identified the following areas as being central to the fulfillment of these responsibilities;

- offer a product mix which will generate adequate volume at both wholesale and retail and provide maximum gross margin to retailers;
- develop advertising and promotion plans which will generate volume profit at retail;
- maintain wholesale inventories at a level which will strike a satisfactory balance between loss of sales due to stockouts and the cost of carrying excess inventory;

*This case was prepared by David P. Norton, Research Assistant, under the supervision of Associate Professors F. Warren McFarlan and Richard L. Nolan.

- maintain high quality in "drawing card" areas such as meat and produce;
- tailor retail pricing structures by store to local competititve conditions.

The Product Mix

In developing a product mix for their wholesale and retail customers, the merchandising department must determine what new products to add to the product line and what existing products to discontinue: decision making in this area tends to be subjective at present. Potential new items are introduced to Hannaford by the vendor's sales representative. In an interview session, the appropriate Hannaford buyer determines pertinent information about the new product...cost, case size, test market data, anticipated advertising expenditures and promotion allowances. The information is recorded on the "fact sheet" ...a standard form used throughout the industry. After consolidating this information the buyer then presents his recommendation and justification to the Buying Committee...a panel made up of three buyers from the other merchandising areas. The Buying Committee accepts or rejects the new product, basing this decision on their feel for what will generate sales volume. One executive noted,

> We're more concerned with whether the item will sell or not sell, rather than its contribution. If a product sells then we make money on it.

The decisions of the Buying Committee are ultimately reviewed by the Grocery Merchandiser, the Vice President of Merchandising and the Vice President of Store Operations. Don Young, Merchandising Vice President, explains,

> We use our buying desk as a training ground for other jobs. The people there are relatively inexperienced so we review their decisions to make sure they're correct most of the time.

Computer-based information provides some small assistance in the analysis of new products. The Wholesale Sales Analysis Report (see Exhibit 1) for similar items as well as the general category in which the new product fits is

Exhibit 1

HANNAFORD BROTHERS CO. (B)

Wholesale Sales Analysis Report

Quarter 4 Wholesale Sales Analysis Report - 10/04/70 thru 01/02/71

Item No.	Pack	Size	Description	Case Cost	Cases Sold	Cost This Qtr	Sales This Qtr	Sales Last Qtr	% This Qtr	Sales Last Qtr	Profit This Qtr	% This Qtr	Profit Last Qtr
121000	Macaroni		Total			46,958	55,536	58,040	42.1	43.9	8,578	15.4	16.6
122020	Macaroni		Products Spaghetti		Regular								
122200-9	8	3 lb	Staff Thin Spaghetti	4.02	500	1,933	2,441	2,637	43.3	65.8	508	20.8	23.2
			Sales Plan		817	3,121	3,203	1,372	56.7	34.2	82	2.6	2.6
			Total		1317	5,054	5,643	4,009	13.2	9.5	589	10.4	16.1
126700-4	20	1 lb	Prince Spaghettini 2	4.60	1056	4,854	5,668	5,995	13.3	87.4	814	14.4	10.7
			Sales Plan					862		12.6			12.5
			Total		1056	4,854	5,668	6,858	13.3	16.3	814	14.4	10.9
127500-7	12	2 lb	Prince Thin Spaghetti	4.90	704	3,418	4,200	4,137	74.6	9.8	782	18.6	15.7
			Sales Plan		306	1,387	1,432		25.4		45	3.1	
			Total		1010	4,806	5,632	4,137	13.2	9.8	826	14.7	15.7
122100-1	8	3 lb	Staff Spaghetti	4.02	459	1,774	2,254	2,404	45.0	65.2	480	21.3	23.2
			Sales Plan		704	2,689	2,760	1,282	55.0	34.8	70	2.6	2.6
			Total		1163	4,463	5,014	3,686	11.7	8.7	551	11.0	16.0
127800-1	8	3 lb	Prince Thin Spaghetti 2	4.90	844	4,111	4,811	4,802	11.3	11.4	700	14.5	12.5
127700-3	8	3 lb	Prince Spaghetti 3	4.90	638	3,105	3,836	3,630	8.5	8.6	531	14.6	12.1
126400-1	20	1 lb	Prince Spaghetti 3	4.60	667	3,065	3,581	4,352	8.4	82.1	516	14.4	10.5
			Sales Plan					946		17.9			12.6
			Total		667	3,065	3,581	5,298	8.4	12.6	516	14.4	10.9
124000-1	8	3 lb	Meuller Thin Spaghetti	4.83	385	1,860	2,100	2,189	4.9	5.2	240	11.4	10.4
123500-1	20	1 lb	Mueller Thin Spaghetti	4.58	273	1,250	1,457	1,635	3.4	3.9	207	14.2	10.1
123400-4	20	1 lb	Mueller Spaghetti	4.58	238	1,090	1,254	1,319	2.9	3.1	164	13.0	9.4
121800-7	20	1 lb	Staff Thin Spaghetti 9	3.55	305	1,035	1,434	1,489	3.4	3.5	399	27.8	28.0
121700-9	20	1 lb	Staff Spaghetti 8	3.55	248	835	1,155	1,167	2.7	2.8	320	27.7	28.0
123000-2	24	8 oz	Mueller Thin Spaghetti	3.18	159	506	603	609	1.4	1.4	98	16.2	14.9
122900-4	24	8 oz	Mueller Spaghetti	3.18	90	286	344	476	.8	1.1	58	16.8	15.2
126500-8	12	16 oz	Prince Curly Spaghetti	3.30	60	198	263	351	.6	.8	65	24.6	23.8
123600-9	20	1 lb	Mueller Spaghetti Twist	4.58	22	101	125	517	.3	1.2	24	19.3	19.4
122020	Regular		Total			36,618	42,719	42,173	98.7	98.3	6,100	14.3	13.9
122040	Macaroni		Products Spaghetti		Flat (Linquine)								
125300-4	20	1 lb	Prince Linquini 11	4.66	100	460	577	737			117	20.3	19.5
122040	Flat (Linquine)		Total			460	577	737	1.3	1.7	117	20.3	19.5
122000	Spaghetti		Total			37,078	43,296	42,909	32.8	32.5	6,217	14.4	14.0

reviewed to provide a feel for the volume which can be expected as well as its potential impact on the present product line. Further use of the computer in this area is not anticipated.

The decision to delete products from the product mix occurs continuously. One stimulus for this decision is new product proposals from the suppliers. It is estimated that 29 new frozen food items are issued in an average week. The retail outlets are obviously constrained by space in their freezer cabinets. If a new product is added, something must be deleted. In addition to this ongoing review of the product line, periodic reviews are conducted for each product group while the more competitive groups, such as candies and cereals, receive more frequent review. Product movement and profitability reports, such as those shown in Exhibits 1 and 2, aid the merchandisers in making these decisions. An item is generally eliminated in a small number of stores first to test the decision.

The possibility exists that the role of the computer could be expanded in this area...particularly in flagging items whose sales are on the decline. Presently such declines must be detected visually by the buyer.

Inventory Control

Inventory planning and control is the most heavily computer-oriented area in merchandising. Hannaford has recently converted to IBM's IMPACT system. At the end of 1971, approximately 80% of the grocery, dairy and frozen food items handled by Hannaford were implemented on the system. In addition to providing a record of physical inventory, IMPACT uses the sales history of the past two years to predict sales in the next quarter. Sales figures are based on transfers from the warehouse to the retail stores. Since inventory is not kept at the retail level, warehouse transfers are assumed to represent retail sales. Don Young observed,

> Until someone develops a universal product code and an economical scanner and mini-computer, it is unreasonable to keep store inventory. This is probably three years away. Until that happens we have to assume that warehouse withdrawals are retail sales. We're operating with only one-half of the information but it's the best we have.

Exhibit 2

HANNAFORD BROTHERS CO. (B)

Product Category Profitability Report

Quarter 04 Product Category Profitability Report - 10/04/70 thru 01/02/71

Own-Str No. 90	Store Name	No. Product Category	LVL	------Sales------- This Quarter	Last Quarter	--Per Cent Sales-- Last Qtr	Curr Qtr	Grp Avg	-----Profit------ This Quarter	Last Quarter	Per Cent Profit Last Qtr	Curr Qtr	Grp Avg
0125		02 Tobacco Products	1	17,220.94	19,184.83	100.0	100.0	100.0	1,476.36	1,635.00	8.5	8.5	8.6
		Sales Plan	1										
		Total	1	17,220.94	19,184.83	12.1	12.9	14.6	1,476.36	1,635.00	8.5	8.5	8.6
		03 Candy and Gum	5	4,469.71	4,679.39	99.6	99.5	99.2	1,347.98	1,367.49	29.2	30.1	30.3
		Sales Plan	5	20.72	15.98	.3	.4	.7	4.72	3.18	19.8	22.7	22.7
		Total	5	4,490.43	4,695.37	2.9	3.3	3.3	1,352.70	1,370.67	29.1	30.1	30.3
		04 Nuts	5	1,244.16	815.82	91.6	72.1	73.1	411.14	253.41	31.0	33.0	32.9
		Sales Plan	5	481.44	73.92	8.3	27.8	26.8	96.74	13.42	18.1	20.0	19.9
		Total	5	1,725.60	889.74	.5	1.2	1.2	507.88	266.83	29.9	29.4	29.4
		06 Baby Food	4	1,947.88	2,128.39	91.6	90.8	91.4	192.81	249.99	11.7	9.8	9.2
		Sales Plan	4	197.28	193.56	8.3	9.1	8.5	21.36	10.49	5.4	10.8	10.8
		Total	4	2,145.16	2,321.95	1.4	1.6	1.8	214.17	260.48	11.2	9.9	9.3
		08 Pickles and Olives	5	1,781.04	1,776.48	79.1	80.7	82.2	574.08	543.05	30.5	32.2	32.5
		Sales Plan	5	424.24	468.90	20.8	19.2	17.7	95.82	94.87	20.2	22.5	22.6
		Total	5	2,205.28	2,245.38	1.4	1.6	1.5	669.90	637.92	28.4	30.3	30.7
		10 Sauces and Dressings	5	2,854.94	4,304.22	89.1	92.8	92.0	491.27	697.98	16.2	17.2	17.3
		Sales Plan	5	220.58	525.28	10.8	7.1	7.9	16.46	22.28-	4.2-	7.4	7.8
		Total	5	3,075.52	4,829.50	3.0	2.3	2.0	507.73	675.70	13.9	16.5	16.5
		11 Canned and Dry Soup	5	2,912.64	4,851.36	97.2	88.9	87.1	430.82	329.96	6.8	14.7	14.5
		Sales Plan	5	363.04	137.00	2.7	11.0	12.8	19.80	4.20	3.0	5.4	6.6
		Total	5	3,275.68	4,988.36	3.1	2.4	2.5	450.62	334.16	6.6	13.7	13.5
		12 Macaroni Products	5	967.56	1,191.56	87.1	83.1	83.7	187.30	196.05	16.4	19.3	19.0
		Sales Plan	5	196.00	176.40	12.8	16.8	16.2	5.00	4.50	2.5	2.5	2.5
		Total	5	1,163.56	1,367.96	.8	.8	.9	192.30	200.55	14.6	16.5	16.3
		14 Canned Fruit	5	2,793.52	2,978.84	60.6	78.2	69.2	727.50	785.80	26.3	26.0	26.1
		Sales Plan	5	774.20	1,933.79	39.3	21.7	30.7	43.20	203.34	10.5	5.5	3.9
		Total	5	2,567.72	4,912.63	3.1	2.6	2.6	770.70	989.14	20.1	21.6	19.3
		15 Canned Juices	5	2,887.17	3,518.75	76.0	88.2	87.1	565.17	802.09	22.7	19.5	19.8
		Sales Plan	5	384.23	1,105.94	23.9	11.7	12.8	12.21	30.28	2.7	3.1	3.3
		Total	5	3,271.40	4,624.69	2.9	2.4	2.2	577.38	832.37	17.9	17.6	17.7
		16 Canned Vegetables	5	5,221.36	7,034.32	70.8	71.2	68.3	1,412.77	1,823.59	25.9	27.0	27.9
		Sales Plan	5	2,106.49	2,898.07	29.1	28.7	31.6	147.54	332.86	11.4	7.0	6.2
		Total	5	7,327.85	9,932.39	6.2	5.4	5.5	1,560.31	2,156.45	21.7	21.2	21.0
		17 Dried Fruit and Veg	5	1,418.64	1,397.40	100.0	100.0	100.0	402.07	389.11	27.8	28.3	29.4
		Sales Plan	5										
		Total	5	1,418.64	1,397.40	.8	1.0	.7	402.07	389.11	27.8	28.3	29.4

Exhibit 3

HANNAFORD BROTHERS CO. (B)

Inventory Stock Status Report

BUYER NUMBER 4 INVENTORY STOCK STATUS REPORT WEEK ENDING DEC 30, 1970 PAGE 4

SLICE	CARD	PACK	SIZE	DESCRIPTION	ACCENT	[illegible]	TOTAL		ALLOC AVA.	- ON HAND	ALLOC AVAIL	+ STOCK ADJ	- NET SALES	SALES + SALES ADJ	- NET	REC + REC ADJ	+ OLD BALANCE
44	266	12 A	8 OZ 19	KR IND WR NAT SWISS SLI 1.1 6.10	7.0	522790-5 103.70	20	20	20				17	17			17
44	270	24 A	8 OZ 22	KR NAT SWISS SLICES 9.5 10.88 2,273.92	14.0	522800-2	209			209	209						209
44	280	12 A	10 OZ 26	KR MUENSTER STICK 1.6 6.77 108.32	8.0	523400-0 115.09	41	25	25	16	16		17	17			33
44	285	12 A	8 OZ 5	KR BLUE CHEESE DRESS 1.2 3.90 23.40	12.5	553940-8 15.60	6			6	6		4	4			10
44	290	12 A	6 OZ 13	KR BLUE CHEESE 3.2 4.98 9.96	5.0	525080-0 59.76	42	40	40	2	2		12	12			14
44	295	6 A	6 OZ 16	KR ROMANO WEDGES 1.9 2.94 17.64	3.0	525560-9 32.34	30	24	24	6	6		11	11			17
44	297	12 A	8 OZ 21	KR SHREDDED MOZZARELLA 1.7 6.17 92.55	7.0	522660-0 86.30	35	20	20	15	15		14	14			29
44	300	12 A	12 OZ 7	KRAFT BABY MUENSTER 1.7 7.69 15.38	10.0	525470-1 76.90	12	10	10	2	2		10	10			12
44	305	12 A	8 OZ 17	KR CASINO GOUDAS 2.4 6.03	7.5	525320-0 75.13	40	40	40				11	11			11
44	310	12 A	12 OZ 20	KR UNEAST MED SHARP CHED 3.6 8.16 579.36	10.0	523370-5 89.76	71			71	71		11	11			82
SLIDE 44	TOT			19,102.35		11,902.39											
45	10	12 A	8 OZ 41	KR PROVOLONE SLICES 2.0 5.80 110.20	7.0	522770-7 121.80	84	65	65	19	19		21	21			40
45	15	12 A	8 OZ 71	KR MOZZAR SLIC IND WRAPT 1.9 5.93 260.92	7.0	522600-0 284.64	134	90	90	44	44		48	48			92
45	20	12 A	16 OZ 33	KRAFT SLIC MOZZARELLA 1.6 10.80 129.60	13.0	522710-3 345.60	52	40	40	12	12		32	32			44

The basis for inventory planning and control at Hannaford's home office is the weekly buying cycle. Each week the "Inventory Stock Status Report" (Exhibit 3) provides the merchandisers with an updated record of the past week's sales, the items on order and the stock on hand. Clerical personnel in the merchandising department transfer this information onto a card file. There is one card for each of the grocery items stocked by Hannaford. The card has space for the 52 weekly entries of sales, stock-on-hand, and ordered. The buyers then refer to this record as a basis for making buy decisions in the following week. This card file has been the traditional device used by the buyers through the years. In making a buy decision, the buyer makes reference to sales levels and trends over the previous four weeks, as well as the seasonal factors (which are quite significant due to Maine's heavy influx of summer tourists) from the previous year's records. In addition, the buyer uses this card to make notes for himself concerning individual products. Existing computer-based systems have not provided the buyers with the ability to review sales from past periods and thus the card file has been maintained. Expansion of the Stock Status Report to provide this information is considered a candidate project in the near future.

The buyer is guided in his activities by a "per cent of service" objective which he is expected to meet. This identifies the amount of "stockouts" which Hannaford is willing to accept at the warehouse. On some items stockouts are never permitted. On the average an attempt is made to keep stockouts under 4% or 96 "per cent of service" to the retail outlets. It would be incorrect to say that stockouts are planned, however, since 95% of all stockouts are due to uncontrollable external causes (e.g., vendor or transportation problems).

The buyer has been aided in his task by the introduction of the IMPACT system. This system provides the buyer with an exponentially smoothed forecast of sales which he uses, in addition to the card file, in arriving at his buying decisions. Young observed,

> Previous to IMPACT we ordered by guessing. Now we can pretty well determine where we are going to be. IMPACT has permitted us to increase our per cent of service to the stores as well as our inventory turnover ratio.

Two major computer-based applications would be of significant value to the decision maker in this area. The first involves an extension of the present system for grocery inventory control, purchase order writing and retail sales analysis to encompass the meat and produce areas. Although these systems would require a substantial amount of programming effort (30 man-months), it is essential that they become computer-based in order for Hannaford to have total control over the product mix being sent to the retail stores. Further, there should be substantial economies in the distribution center itself as functions currently performed manually become computer-based.

A related development, which holds promise, is the use of linear programming to determine optimum meat yields. Currently computed manually, this is a key decision in the planning and control phases of meat merchandising. This application would require only three man-months of programming activity.

Advertising and Promotion

The basis for Hannaford's advertising and promotion process is the weekly "sales-plan." A sales-plan encompasses the items which will be sold as "specials" and advertised on a weekly basis. Because these are high-volume, low-margin items designed to create traffic in the stores, a separate set of problems arise in determining what size purchases should be made from a vendor. A separate sales-plan is prepared for grocery, meat and produce and is currently prepared manually and intuitively. The appropriate merchandiser is given a set of guidelines concerning what mark-up is desired on sales-plan items and what percentage mark-down is acceptable to Hannaford as a company. The "mark-down" is the over-all reduction in gross margin which results from the price reductions while "mark-up" is the average gross margin on sales-plan items. The development of a sales-plan involves achieving a balance between these two conflicting variables. For example, the desired mark-up on sales-plan items may be between 7% and 10% while a 2% mark-down is acceptable. Thus if a store's gross margin is normally 20%, the low-margin sales-plan items will be permitted to reduce over-all gross margin to 18% (i.e., a 2% mark-down).

As mentioned above, a sales-plan is prepared manually

and intuitively. Items are selected for the sales-plan based on the merchandisers' experience as to what creates traffic and based on what the competition is doing. In order to retain the image of their outlets as low-priced stores, the first objective is to meet the competition. The merchandiser uses a work sheet similar to that shown below to evaluate various sales-plan combinations, estimating the volume which items will generate at a given price and then computing the over-all mark-up and mark-down. This process is iterated until an acceptable sales-plan is arrivated at. After the sales-plan has been prepared by the merchandiser, it is forwarded to the retail stores. The stores then order a specific quantity of each item on special. After the week has been completed, selected stores take a physical inventory of the remaining sales-plan items and forward this information to the appropriate merchandiser. The results of the "sales-plan" are

ales-Plan Items	Unit Price	Est. Volume	Retail Sales	Unit Cost	Total Cost
______	______	______	______	______	______
______	______	______	______	______	______
______	______	______	______	______	______
______	______	______	______	______	______
______	______	______	______	______	______
______	______	______	______	______	______
______	______	______	______	______	______
______	______	______	______	______	______
Total			A		B

$$\text{Mark-up} = \frac{A - B}{A}$$

Mark-down =

$$20 - 20\,[1 - (\text{A/Total Sales})] + (\text{A/Total Sales}) \cdot (\text{Mark-up})$$

then reviewed to determine the over-all mark-down absorbed by Hannaford. Commenting on the adequacy of the merchandiser's feel for price-volume relationships, Don Young observed,

> Although our present method of preparing a sales-plan is strictly intuitive, we've found that if a man has done this for a sufficient number of years, his preplanning gets quite close to the actual sales. While he may be in error for each of the 20 items on the sales-plan, collectively he will be quite close. It's the over-all that's really important.

Young feels that the computer holds much promise for improving decision making in this area.

> The sales-plan is not that easy. First, we have to guess what 60 store managers are going to order, who in turn guess what 2,000 to 3,000 customers per store are going to order. If you miss and they miss, the cost of error becomes quite significant since we base our buying decisions on these estimates. We get into more trouble with excess inventory on sales-plan items than we ever do on routine shelf merchandise.

A computer model which could quickly perform the required computations would aid the merchandiser in preparing the sales-plan. Such a system would still rely on the merchandiser's volume estimates. To be of value, the merchandiser would have to have immediate access to the computer in order to experiment with various sales-plans. Programming of this computer model would require approximately three man-months of programming.

Retail Pricing

The retail pricing philosophy of Hannaford-supported outlets is determined by the "price zone" to which the store belongs. A price zone refers to the over-all pricing philosophy to which the store will adhere. Different price zones are established to reflect whether or not the outlet is a "discount store," whether or not it gives stamps, its geographic proximity to the distribution center and the philosophy of the store with respect

to meeting competition. Hannaford has established seven price zones to govern pricing at the retail level.

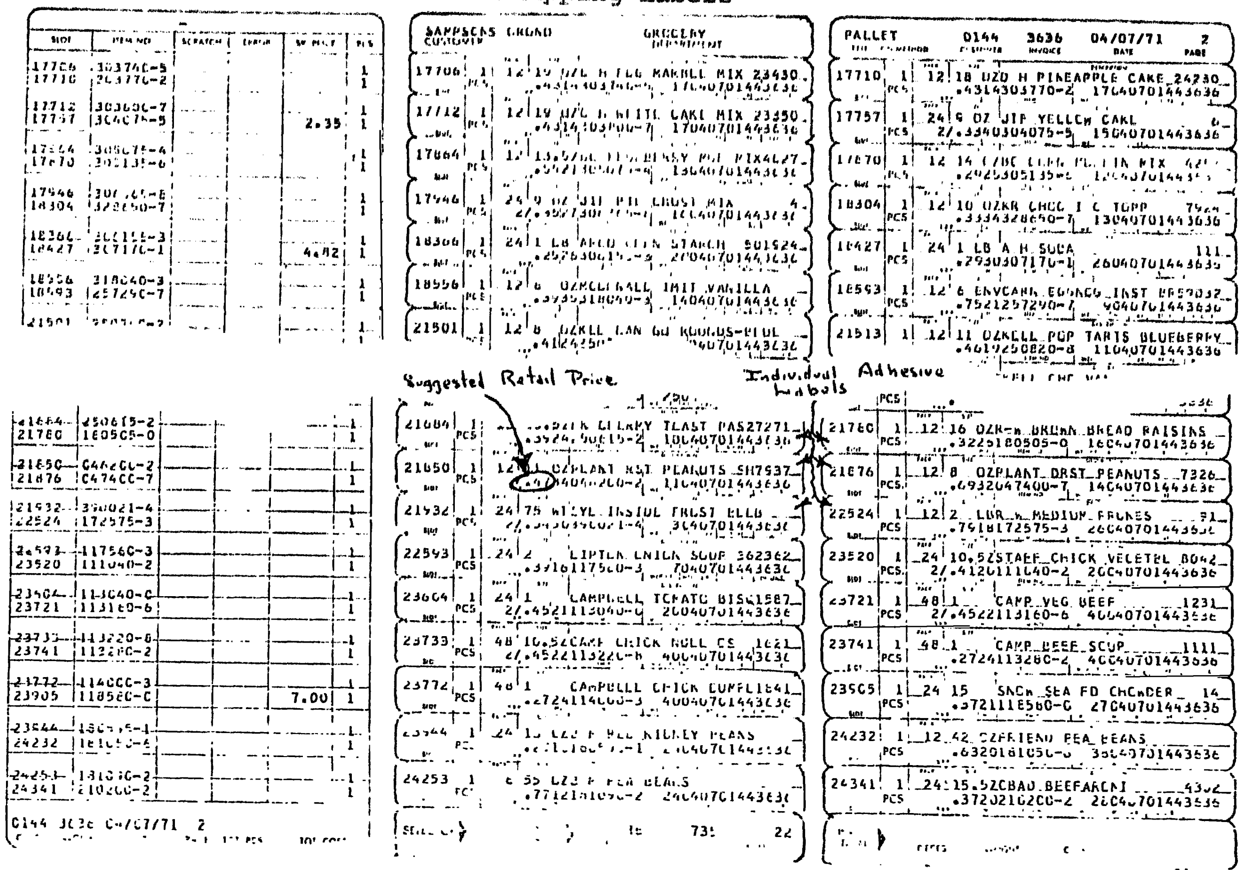
A pricing specialist is assigned the task of implementing the company's pricing policy. Of the nearly 5,000 grocery items handled by Hannaford's outlets, between 500 and 800 have been identified as being price-sensitive... that is, the consumer is aware of price levels. The pricing specialist monitors these items quite closely, attempting to stay below the competition. A "price index" has been developed which incorporates a representative mix of products in several product groups. Competitors' prices are periodically surveyed and compared with Hannaford's according to this index. In highly competitive areas Hannaford attempts to stay below the competition on every index, as the company views itself as the price leader in Northern New England.

A computer-based system plays an integral role in changing and implementing pricing policy. If the cost (to Hannaford's warehouse) of an item is increased by a vendor, the computer flags this fact for the pricing specialist. The specialist must then determine if the increase can be passed on to the consumer. This involves assessing the moves to be taken by the competition. The ultimate objective is to get retail prices back to the level where the original mark-up can be attained.

The recommended retail price of each item is contained on each shipment sent to the retail stores. At the time the items are picked from the warehouse, prior to their shipment, an adhesive label is placed on the side of each case. This label contains the recommended retail price (see Exhibit 4) and provides the basis for price marking on individual product containers (i.e., cans, boxes, etc.) that takes place in the store itself.

Decision making in the area of pricing would be aided by the computerization of inventory, ordering and analysis of meat sales...the potential system mentioned earlier. Presently meat pricing is done manually with a resulting difficulty in easily reflected changes. A further project which would aid decision making in this area would be the development of computer models to indicate the sensitivity of demand for different products to price. Although significant difficulties might be anticipated in developing such a model, the competitive advantages which would result would be significant.

Exhibit 4
HANNAFORD BROTHERS CO. (B)
Warehouse Shipping Labels



WAREHOUSE AND TRANSPORTATION

The warehouse and transportation department, managed by Everett ("Ike") Johnson, is responsible for receiving, storing and shipping all products from the Portland distribution center. About 86% of Hannaford's wholesale sales are of products shipped to customers from the distribution center. Of this volume, about 80% is shipped in company-leased vehicles. The operations of the distribution center involve three major functions:

- maintaining a system for receiving, storing and locating products in the warehouse
- provide accurate and timely shipments to retail stores
- control the operating costs of the distribution process.

The nature of these activities as presently performed and the potential for the further use of computers is discussed in the following paragraphs.

Receiving The warehouse job follows in sequence the buying process described earlier. At the time a buyer submits a purchase order (see Exhibit 5) to a vendor, the information contained on that order is entered into the computer. Each day the "Purchase Order Due-In" (see Exhibit 6) report identifies those shipments which are scheduled to arrive, as well as the shipper, the composition of the shipment and the warehouse "slot" in which it is to be stored. The trucking or rail company generally calls the Hannaford traffic manager on the day prior to delivery for an appointment time and an unloading dock assignment. Shipments are generally unloaded on the day shift only. The data-processing system is notified of the shipment's arrival. Generally this notification takes place on the day prior to the actual receipt of shipment, thus advancing the "stock-on-hand" records by one day. This prevents the computer from showing stockouts even though one may exist at the time but will be alleviated prior to the time that shipments to the stores are prepared.

A possible use of computers in performing this function is in the scheduling of truck unloadings. At present the "Due-In" report identifies the items, quantities and weights

Exhibit 5

HANNAFORD BROTHERS CO. (B)

Purchase Order Form

VENDOR COPY

BILL TO: Hannaford — HANNAFORD BROS CO

SHIP TO: 54 Hannaford Street Rumery Park South Portland Maine

PURCHASED FROM

DEL MONTE CORP
DEL MONTE CORP
215 FREMONT STREET
SAN FRANCISCO CALIF 94105

VENDOR NO. PER CUSTOMER: 1/8100

CUSTOMER NO. PER VENDOR:

SHOW ORDER NO. ON ALL INVOICES, BILLS OF LADING & LOADING SHEETS

PURCHASE ORDER

ORDER NUMBER: 1GRD2951

DATE ORDERED:

PAGE: 2

NOTIFY OUR TRAFFIC DEPT. IF UNABLE TO MEET ARRIVAL DATE

TO ARRIVE:

MAIL INVOICE IN TRIPLICATE & ORIGINAL BILL OF LADING TO BILL TO ADDRESS
NO SUBSTITUTIONS, CHANGES IN PACK OR BACK ORDERS WITHOUT AUTHORIZATION

BUYER 01 SLIDE 02

BUYER

CARRIER AND/OR ROUTING
VIA PRSL-RDG-CNJ-DGH-BGM

TERMS: 2.0, 10, NET 30

FREIGHT CHARGES: P

FREIGHT ASSUMED BY: V

F.O.B.: DESTINATION

CASES ORDERED	ITEM NUMBER PER CUSTOMER	ITEM NUMBER PER VENDOR	VENDOR CASE CONTENT	PACK	SIZE	DESCRIPTION	QTY ALLOC SHIP UNITS	
	145320-8	0001044	1 CASE	24	16 OZ	DEL MTE YC HV PEACH 1044		
	145470-1	C001065	1 CASE	24	16 OZ	DEL M SLIC YC PEACH		
	144950-3	0000000	1 CASE	24	16 OZ	DM SLI ELBERTA PEACHES		
	145740-7	0001062	1 CASE	24	29 OZ	DEL MONT SLI YC PEAC		
	145590-6	0001041	1 CASE	24	29 OZ	DEL M YC PEACH HVS		
	146250-6	0001025	1 CASE	24	16 OZ	DEL MONTE PEAR HVS		
	146490-8	C001022	1 CASE	24	29 OZ	DEL MONTE PEAR HVS		
	146130-0	0001020	1 CASE	24	8.5 Z	DEL MONTE PEAR HVS		
	147900-5	0001116	1 CASE	12	17 OZ	DEL MONTE DELUXE PLUMS		
	166360-8	0000000	1 CASE	24	8 OZ	D M STEWED TOMATOES		
	166920-9	0001323	1 CASE	24	16 OZ	DEL M STEWED TOMATOES		
	166440-8	C001326	1 CASE	24	16 OZ	DEL MONTE SP TOMATOES		

SHIP ONLY WRITTEN AMOUNT - SHOWN IN QUANTITY ORDERED - COLUMN

The seller of this merchandise by the acceptance of this order guarantees that the product described in this purchase are not adulterated or misbranded within the meaning of any state laws or of the Federal Food Drug and Cosmetic Act and amendments thereof now in force nor are they articles which may not be introduced into interstate commerce under the provisions of Section 404 or Section 505 of the Act. The seller by the acceptance of this order agrees to save Hannaford Bros. Co. harmless and indemnified from all loss, damage, liability or expense incurred, suffered or claimed by reason of the presence of any foreign substance in or the deleterious condition claimed with reference to any of the merchandise referred to in this purchase order.

In filling this order the seller warrants that the prices of the goods and any discounts and allowances therefrom do not reflect any brokerage or brokerage savings whatsoever, and are available on proportionally equal terms to all other buyers after making due allowance for differences in the seller's costs (other than brokerage) and for the seller's right to select his customer and/or to change his prices pursuant to market conditions and/or to meet competition.

Exhibit 6

HANNAFORD BROTHERS CO. (B)

Purchase Order Due-In Report

1/29/71 PURCHASE ORDER DUE IN REPORT PAGE 1

VENDOR NUMBER	VENDOR NAME	SHIP	PURCHASE ORDER NUMBER	ORDERED	DUE	BUYER	SLIDE
5826-01	PRINCE MACARONI CO	TRUCK	4GTP3278	1/25/71	1/29/71	4	72

VENDOR ITEM NUMBER	PACK	SIZE	CASES ORD	CASES RECVD	HANNAFORD ITEM NUMBER	PACK	SIZE	DESCRIPTION	QTY ORD	QTY ALLO	RETAIL COST	SLOT	PALLET TYP	TI HI	SELECT CS	PT	MTH	CASE CU FT	WT LB
0000001	1	CASE	77		127000-8	20	1 LB	PRINCE VERMICELLI 1	77		4.60	38300	L	18X 3	54	22	F	.58	23.0
0000002	1	CASE	120		126700-4	20	1 LB	PRINCE SPAGHETTINI 2	120		4.60	38261	L	18X 3	54	33	F	.58	22.0
0000003	1	CASE	77		126400-1	20	1 LB	PRINCE SPAGHETTI 3	77		4.60	38253	L	18X 3	54	33	F	.58	22.0
0000005	1	CASE	11		126100-7	20	1 LB	PRINCE PERCIATELLI 5	11		4.60	38280	L	15X 3	45	22	F	.58	23.0
0000011	1	CASE	11		125300-4	20	1 LB	PRINCE LINGUINI 11	11		4.60	38241	L	19X 3	57	22	F	.58	23.0
0000018	1	CASE	15		125000-0	12	1 LB	PRINCE ALPHABETS 18	15		2.76	38236	L	15X 4	60	20	F	.46	15.0
0000025	1	CASE	170		125400-2	20	1 LB	PRINCE ELB MACARONI 25	170		4.60	38200	L	8X 5	40	30	F	.80	23.0
0000029	1	CASE	25		125500-9	20	1 LB	PRINCE CUT MACARONI 29	25		4.60	38212	L	8X 4	32	20	F	1.00	23.0
0000030	1	CASE	10		125800-3	20	1 LB	PRINCE MEZZANI 30	10		4.60	38220	L	7X 4	28	20	F	1.00	23.0
0000032	1	CASE	30		127100-6	20	1 LB	PRINCE ZITI 32	30		4.60	38312	L	7X 4	28	15	F	1.00	23.0
0000036	1	CASE	24		126200-5	20	1 LB	PRINCE RIGATONI 36	24		4.60	38292	L	5X 4	20	9	F	1.70	23.0
0000040	1	CASE	40		126800-2	20	1 LB	PRINCE MED SHELLS 40	40		4.60	38273	L	5X 4	20	12	F	1.38	24.0
0000062	1	CASE	30		126300-3	12	1 LB	PRINCE ROTINI 62	30		3.30	38296	L	8X 4	32	20	F	1.00	15.0
0000014	1	CASE	60		125200-6	12	1 LB	PRINCE CURL LA SAGNA 14	60		3.95	38245	L	10X 2	20	12	F	1.07	15.0
0000089	1	CASE	10		124300-5	12	12 OZ	PRINCE SMALL BOWS 89	10		3.57	38197	L	15X 5	75	30	F	.28	11.0
0000092	1	CASE	30		124500-0	12	12 OZ	PRNC FL FINE NOODLES 92	30		3.35	38144	L	10X 3	30	12	F	.97	11.0
0000094	1	CASE	65		124600-8	12	12 OZ	PRINCE FLUFF MED NOOD 94	65		3.35	38140	L	10X 5	50	35	F	.99	11.0
0000095	1	CASE	88		124700-6	12	12 OZ	PRINCE FLUFF WIDE NOOD95	88		3.35	38152	L	10X 5	50	35	F	.99	11.0

of each shipment but no record is kept of the unloading times. The ICC (Interstate Commerce Commission) makes standard allowances for truck unloading (referred to as "free time"). Any time beyond that must be paid for by the company taking receipt. This has increasingly become a problem. It is felt that some shipments cannot possibly be unloaded in the allotted "free time" while in other cases the driver may be "dragging his heels." The development of standards based on shipment weight or bulk would aid Hannaford's management in isolating the cause of such problems in a given situation, thus permitting a rational approach to its solution.

Storage The warehouse is divided into a number of "slots" or storage bins. Each product (item number) is assigned to a unique slot. The slots are physically laid out in "family groups" (e.g., all cereals are in contiguous slots as are canned fruits, canned vegetables, etc.). The family groupings are of value when shipments to the retail outlets are prepared, since retail stores tend to be laid out according to these same family groupings. Thus merchandise from the same family grouping is easily packed together when a shipment is being prepared and is conveniently located together for stocking on the retail outlets' shelves. The family groupings are further classified into four broader categories:

- fast-moving
- slow-moving
- bulk (e.g., paper goods)
- repack for shipment (items shipped in less than one case quantities--e.g., candy, cigarettes).

Within family groupings an attempt is also made to separate the fast- and slow-moving items.

Since each product is permanently assigned to a slot and this slot is identified on the "Due-In" report, the task of storing merchandise is fairly straightforward. However, opportunities do exist where the computer could provide some payoff in the future. The first is referred to as "preslotting." Whenever a new item is entered into the warehouse product mix, it must be assigned to a slot. Ideally this slot will rest physically within the proper family group and volume movement class. The slot assignment for new items is presently done manually by warehouse personnel. It is suspected that this assignment is

based more on the expediency of an open space rather than the more desirable family-group/volume rationale. An ever-increasing number of new items are being slotted outside of their family grouping. The economic impact of this is felt, not at the warehouse, but at the retail level where inefficiencies in shelf-stocking might result from shipments which are not appropriately grouped. It is felt that a computer model to aid in preslotting would force a more consistent and desirable rationale to the assignment of slots. It would force the warehouse personnel to communicate with the buyers to estimate new product volume. In addition, a computer model would permit one to identify the number of items which are slotted outside of their family groupings. At present, such a determination cannot be made.

Shipment The daily shipments to the retail outlets are driven by the store level ordering process which will be described in detail in a future paragraph. At this point it is sufficient to note that the orders from the retail stores are sent via the U.S. mail and arrive at Hannaford's data-processing center throughout the day. The orders are key punched as they are received and submitted for computer processing. The "Selector/Shipment Sheet" (see Exhibit 4) is the central report used in preparing a customer order. The computer sorts a customer order by warehouse slot number (note the extreme left-hand column of Exhibit 4) in order to minimize the warehouse picking time. The warehouse selector (picker) works from this report, moving from slot to slot and loading the specified number of cases of each product onto a wooden pallet which is carried on a motorized cart. The adhesive label is removed from the selector sheet and placed on the side of the case at this time. In addition to providing pricing information to the retail stores, the use of this label also helps insure that selectors do not inadvertently skip items while making up a shipment. The height to which a selector can pile cases on the wooden pallet is ultimately constrained by the height of the back door of the truck on which it will be shipped. In order to simplify this process a standard unit of volume, referred to as a "cube," has been determined. This volume is the number of cubic feet which will translate into a height of approximately six feet (the truck's back door height with a safety factor left to adjust for variations). The computer keeps a record of the volume (in cubic feet) of each

grocery item contained in the warehouse. Each "Selector/ Shipment Sheet" represents one cube: the quantity of product which should fit conveniently through the truck's back door. It is the job of the selector to insure that the pallet is packed tightly enough to make this cube method of loading effective.

Since a customer shipment will be made up of several grocery cubes, as well as produce which is ordered at a later point in time and special last-minute requests, the computer cannot determine the composition of an entire truck's load. This is done manually by the warehouse traffic manager. The Customer Invoice record (see Exhibit 7) contains a record of all invoices and pallets which are going to a specific store. In some cases an entire truck will be required to service a single store. More typically, two to three store orders are carried on a single truck. The traffic manager reviews the invoice recorded and determines what orders will be assigned to each truck. This tends to be a repetitive process from week to week with the same trucks servicing the same group of stores. In instances where an entire customer order will not fit on one truck (this does not become apparent until the truck is loaded) the remainder of the customer order will be assigned to another truck which is scheduled to pass through that general area.

Since produce is not contained on the normal selector sheet (primarily because produce orders are submitted separately and later in the day by retail stores due to their perishable nature) and because Hannaford wishes to remain responsive to last-minute special requests, further use of the computer is not seen in this area of load preparation. One possible application does exist, however, in scheduling the slots for refilling. When a shipment of product is received the new shipment must be stored temporarily in another area. As selectors remove the existing product from the slot, an "apparent" stockout condition is created until the new shipment can be located in its temporary storage area and moved into the slot. It is felt that by developing some product movement profiles and standards, the movement of new shipments from their temporary storage area into the slots for selectors might be scheduled more rationally and effectively. Such an effort would require a significant industrial engineering study as a starting point.

Warehouse Labor Control The present method for

Exhibit 7

HANNAFORD BROTHERS CO. (B)

Customer/Loading Worksheet

CUSTOMER NO. [illegible] [illegible]

Hannaford [illegible]

LOAD NO. 2-104 DELIVERY DATE 04/07/71

INVOICE NO	PCS	GROSS PCS	\	NET PCS	WEIGHT	CUBE
GROCERY						
3631	6	212			5485	160
3637	2	50			1178	90
3638	1	7			420	34
REPACK ROOM						
3633	3	NET REPACK CARTONS				
3635	1				111	4
3639	1				150	3
	14	369			7344	
TOTAL						
STAMPS						
3634	1					

INVOICE NO	PCS	GROSS PCS	\	NET PCS	WEIGHT	CUBE
ADVERTISING						
DAIRY						
3640	1	54			661	13
TOTAL	1	54			661	
PRODUCE						
FROZEN FOOD						
TOTAL						
MEAT						

SCRATCHES - CREDIT WILL FOLLOW

INVOICE NO	PCS	PCS	ITEM NO.	SALE PRICE	INVOICE NO	OF	PCS	ITEM NO.	SALE PRICE

	NET PCS.	WEIGHT	CUBE	CREDIT NOS.
GROCERY				
REPACK ROOM				
TOTAL				
STAMPS				
ADVERTISING				
DAIRY				
PRODUCE				
FROZEN FOOD				
MEAT				

DRIVER	TRACTOR	BOX	TRIP HELPER	TRIP MILES

scheduling warehouse labor is based on historical performance. Based on past observation, the warehouse supervisor has a "gut-feel" for how many men are needed to do the job on Monday, Tuesday, etc. If tonnage should run heavy on one shift, then men are kept on overtime to compensate. At present there is no indication at the beginning of a shift as to what the total tonnage to be loaded will be. There is some doubt as to the value of this information, since light bulk items require nearly as much work of the selectors as heavier cases of canned foods. At present the warehouse supervisor keeps records manually of individual worker productivity. The bottom line of the Selector/Shipment Sheet (Exhibit 4) provides a record of the number of pieces selected in putting together a single cube. By compiling these records manually and continuously, it has been noted that 160 pieces per hour represents exceptional performance and that 150 pieces per hour was a reasonable objective. These statistics are an integral part of the warehouse worker's periodic performance appraisal. It is felt that automating the system required to prepare this information would free up the supervisor for more important tasks.

The development of standards for warehouse labor could also provide a basis for reflection on the over-all effectiveness of the present warehouse concept. Ike Johnson explained,

> Our warehouse operation is service-oriented. We could run it a lot less expensively than we do...we could limit shipments to once or twice a week...we could wait until we had a full load...there are a lot of things which we could do if we could make the stores regulate themselves. However, we go in the opposite direction. We try to make our service to the stores as convenient as possible and then try to become efficient within those guidelines. This is part and parcel of our corporate philosophy but we don't always know how much it is costing us. If we had effective standards and a model of warehouse labor, we could reconstruct performance after the fact and show exactly what it would have cost if we had done things in some other way.

RETAIL STORE OPERATIONS

If wholesale operations represent the lifeblood of Hannaford's business, the retail store operations must be considered the heart. The equity-partner concept had produced a total of 57 stores by 1970 which, along with two wholly owned operations, represented 68% of the wholesale transfers. With Hannaford maintaining ultimate control, the equity-partner concept has developed a source of demand on which the wholesale distribution center can depend. However, the equity-partner concept has also given rise to a pattern of operations which is quite unique in the industry. While Hannaford, with their controlling interest, could force conformance to standard methods and procedures, a completely opposite approach is taken. The philosophy toward retail operations is described by James L. Moody, President, as follows:

> We want our retail store operators to have initiative and pride in what they do. In order to achieve this we grant them as much independence as possible. Sometimes this means less efficient operations but on balance it works to our advantage. It's a question of not being able to have your cake and eat it too.

A home office staff, Retail Store Operations, has been established to deal with operating practices in individual stores. The staff, which functions in much the same manner as "District Managers" of the larger chain stores, serve as counselors to the retailers. These individuals are designated as Meat Counselors, Produce Counselors or General Counselors and are assigned specific territories. They visit the stores and work with the store manager in product layout, displays, labor scheduling and implementing systems developed by the home office. The advice of the counselors is strictly optional, however; the store managers retain the prerogative of accepting or rejecting this advice. The counselors, who are generally ex-store managers, are placed in the position of having to sell their recommendations to the retail operators.

The profitable operation of retail stores involves three major classes of decisions:

- the location, design and product mix of new stores which will permit profitable operations

- the logistics associated with ordering, storing and stocking merchandise
- the control of direct costs such as labor and shrink while maintaining an adequate level of service.

Hannaford's philosophy concerning independence at the retail level is reflected in each of these decisions as described in the paragraphs which follow.

New Store Planning

The development of a new store requires the selection of a site, the design of the store itself and the selection of a product mix. The selection of sites and equity partners to operate the stores built on these sites is closely controlled by Hannaford. While the ideal approach to selecting sites for new stores would involve a master plan for developing and penetrating new markets, such flexibility frequently does not exist. Moody explained,

> Quite frequently a developer will put together a shopping center and invite us to participate. We may have a store nearby with five years remaining on its lease. Even though we're not ready to move, we frequently have to or permit a competitor to move in and erode our position.

While frequently pressed by such uncontrollable circumstances, Hannaford's approach is not completely reactionary. The Real Estate Division, headed by Treasurer John Russell, employs the Corporate Research Department, as well as an external consultant to evaluate potential store locations. The research department has conducted customer-attitude surveys in potential new markets to learn more about local conditions and preferences which should influence the ultimate operation of a store.

Once a site has been selected, existing equity partners are offered the opportunity to "buy in." Frequently more than one partner will seek ownership of the same store. Hannaford management awards the store to that operator who appears to offer the most to corporate good. Once [it is] awarded, the new operator participates actively in the design and development of the store. The Store Engineering Department, also headed by the Treasurer, is responsible for developing store designs and layouts. Hannaford's

philosophy toward design is that the store must reflect the desires of the equity partner. The role of the Store Engineer is explained by Jim Moody:

> The Store Engineer has designed many stores, so our equity partners rely on him. The partner knows what he wants and the Engineer knows how to get it. He plays the same role as an architect who bridges the gap between the carpenters, plumbers, electricians and homeowner.

The desires of the equity partners generally prevail to the extent that one partner, who is jokingly believed to be color-blind because of the odd color combinations found in his stores, is still permitted to select his store's decorating schemes.

The initial product mix to be carried in a new outlet is another subjective decision. The partner is aided by the retail counselor in this determination. Generally an attempt is made to identify another outlet in Hannaford's family which is similar in terms of size and clientele to the one being designed. The velocity reports for this store are studied carefully and provide the basis for initial stock levels and shelf-space allocations.

Store Logistics

The logistics required in the operation of a retail store encompass the ordering of merchandise, receipt and temporary storage of merchandise and the stocking of shelves. The store manager is completely responsible for all of these activities. The approaches used vary significantly in detail from store to store. In general, however, the operator submits reorder forms to Hannaford's Portland office several times weekly. The reorder forms are then key punched, submitted for computer processing and provide the basis for the following day's warehouse shipping schedule. Under the present method of reordering, the store manager must walk through the store and observe the stock of each item which is on the shelves. In some stores, the "item number," an ordering code associated with each product, is affixed to the shelf, while in other stores a catalogue listing these product codes is used. The manager must observe the quantity on the shelf, remember the stock he generally carries and determine if

an order is needed. With slower moving items, an order is submitted when store stock is down by one case (the minimum order quantity). With faster moving items an order of several cases may be submitted. After computing his requirements based on reviewing shelf inventory, the store manager checks "backroom" stocks and removes these items from his order. It is suspected that this latter step is frequently performed from memory and that backroom stock is quite often overlooked. Stock in the back room is also more susceptible to "shrink" (e.g., pilferage by employees or other unaccountable losses).

Several proposals have been made to use computers in simplifying this facet of store operations. One such proposal is the "direct store ordering" system. This system incorporates several features to improve store efficiency and profitability. The store order form would be replaced by a small, light-weight number-key device similar to the face of a push-button telephone. When a button is pushed, an audio sound is captured by a small cassette tape recorder which is carried on a strap over the operator's shoulder. All product item numbers will be affixed to the shelves in the stores. The store operator places an order by walking through the store with this unit. For each item to be ordered, the operator presses the appropriate item number and quantity. The device has built-in logic which rejects incorrect item codes. After all items have been entered into the recorder, the tape is rewound. A telephone coupler is then used to transmit the sounds over normal voice-grade phone lines to a central recorder at Hannaford's home office. This audio recording is then converted directly to magnetic tape and the store's daily order is ready to be processed by the computer. It is estimated that the added equipment costs associated with this proposal will be offset by the reduced cost of key punching, forms and mailing.

The primary intent of the direct-ordering system is to provide other than clerical advantages however. The proposed system would cut the delivery cycle in half, thus permitting a partial reduction in inventory and stockouts. Under the present system, the store order is written at the end of a day and placed in the overnight mail. The order is received in Portland, generally on the following morning, is key punched and then processed on the computer where warehouse loading schedules are prepared. A shipment is then made that evening and available for

stocking on the shelves on the following morning, approximately 40 hours after the order was submitted. Under the proposed system, the order would be recorded in the morning, transmitted directly to the computer and be ready for shipping that evening. The order would be on the store shelves within 24 hours of the time it was prepared.

The direct-ordering system also provides a lead-in to a "shelf-allocation" system. At present, a store manager determines how many of each item will be stocked in his stores. There is no uniform method for determining the amount of space to be allocated to each item. A recent study conducted over a 26-week period in one of Hannaford's retail outlets showed the following:

- 8% of the grocer items stocked generated 34% of the store's grocery gross profit
- 2-1/2% of the grocery items stocked accounted for 16% of the profit
- 68% of the grocery items stocked sold less than one case per week.

Research studies elsewhere have shown that the sales of a specific item are favorably influenced by the amount of shelf space allocated to it. Thus the basis for a shelf-allocation system is the assignment of shelf space based on an item's gross margin. This approach has to be tempered by providing a choice of products that will fit the image which the store desires to develop. Therefore, it cannot be entrusted completely to the computer. As visualized at Hannaford, the store manager would be provided with quarterly or semiannual reports which report gross profitability by item. The store manager would be encouraged to use this report as a basis for reviewing the product-mix and shelf-allocation policies. A second facet of the shelf-allocation system is that virtually all inventory is held on the shelves. Only bulky paper-goods and high-volume items being offered on specials are stocked in the back room. A one-day cycle introduced by direct store ordering makes such an approach feasible. Ordering under this system would be conducted on a daily basis where the stock would be replenished when shelf inventory was down by one case. To further simplify the process, all items which sell less than one case per week would be identified (e.g., special colors on the shelf label) and review of these items would be

conducted weekly. In the test stores referred to earlier, 68% of the items would be placed in this category. The "shelf-space allocation" system would further simplify the ordering process, as well as eliminate most backroom inventory, reduce shrink and improve the profitability of the product mix. This project would require approximately six man-months of programming.

Store Control

The day-to-day operation of a grocery store requires control of a labor force which varies quite significantly in size and composition. During the earlier portions of the week, demand is relatively light with peak demand occurring on Thursday, Friday and Saturday. The objective of the store manager is to have an adequate staff of check-out clerks and baggers on hand to provide appropriate levels of customer service. Since patterns of demand vary so widely, determining proper staffing levels becomes a bit of an art. The store manager has considerable flexibility due to the use of part-time help in developing staffing schedules. Traditionally this task has been accomplished by "feel"; that is, by observing the adequacy of staffing in the past and then making adjustments in the future. It has been proposed that a computer-based system be developed to aid the store manager in this task. The system would require a method of determining the time profile of cash register transactions. This could be accomplished by adding a clocking device to the cash register to note the time at which each transaction was completed. An operations analysis would be required to determine the amount of staffing required to limit customer queues to desired lengths. A method of generalizing this so that a store manager could work directly from his own "demand profile" would have to be developed. A relatively modest amount of programming effort (two man-months) would be required to implement such a system.

Another major problem associated with management control in the store is that of shrink. Traditionally the loss of merchandise due to unaccountable reasons has been a problem in the grocery industry. The potential causes are numerous: shoplifting, pilferage by store personnel, damaged goods or clerical error at the cash register. The problem is exaggerated in the grocery industry because perpetual inventories are not kept at the store level and

physical inventories are taken infrequently. The problem is further exaggerated in Hannaford's retail outlets by the fact that not all items sold in their stores are purchased from Hannaford's wholesale operation. On the average, 30% of all sales fall into this category, but in some outlets up to 60% of the sales volume can be attributed to merchandise from other wholesalers. Hannaford's accounting system at present only reflects these items in the aggregate; i.e., cash register sales and payments to direct suppliers. It has been proposed that the accounting system be modified to account for these transactions. The modificaton, referred to as the "direct store delivery" system, would aid the store operator in establishing more complete control by identifying the total mix of products which he receives (referred to as the "back-door mix"). Such a system would also be of value to the merchandising staff in that it would provide a more complete picture of each store's sales mix. The proposed system would require that each invoice for a direct supplier be expanded to identify unit price and quantity. This information is not presently found on the invoices and would have to be entered by the store personnel. Home office personnel could then key punch the information and provide the necessary input to existing systems. It is estimated that three man-months of programming effort would be required to implement this system.

United Farm Workers Organizing Committee and Robert F. Kennedy Memorial Health Plan (A)*

Rodney B. Plimpton
Henry C. Lucas, Jr.

The Dusenberg Foundation
1753 Michigan Avenue
Falls Church, Virginia 11007

August 28, 1970

Mr. James Bosworth, President
Superior Consulting Services
700 Welch Road
Palo Alto, California 94305

Dear Mr. Bosworth:

Mr. John Trauth of the A.U.A. informed me recently of the excellent job your systems group has done on the Association of University Accountants project. Based upon his recommendations we are inviting your firm to sumbit a proposal for a study of the data processing requirements of the United Farm Workers and Robert F. Kennedy Memorial Health Plan to be funded by the Dusenberg Foundation. Details of this project are provided in the attached request for proposals.

Final selection of a consulting firm for the project will be made by a joint committee from the Union, Health Plan and the Foundation. Since we hope to award the initial contract by September 30th, we would appreciate having your proposal in hand no later than September 16th. If you have any further questions after reading the request for proposals please do not hesitate to call me.

Sincerely yours,

Peter A. Lake

Peter A. Lake
Director, Dusenberg Foundation

PAL:lr

*This case was made possible by a grant from the Donaldson, Lufkin & Jenrette Foundation.

THE DUSENBERG FOUNDATION
REQUEST FOR PROPOSALS
UNITED FARM WORKERS ORGANIZING COMMITTEE AND
ROBERT F. KENNEDY MEMORIAL HEALTH PLAN
DATA PROCESSING STUDY

Introduction

The Dusenberg Foundation has recently set up a special fund to improve the management practices in non-profit organizations. A grant from this fund has been jointly awarded to the United Farm Workers Organizing Committee and the Robert F. Kennedy Memorial Health Plan of Delano, California, for a study of their data processing requirements. If this study shows that a computer-assisted data processing system is feasible and desirable, it is anticipated that the grant will be extended to include the system design and implementation. Proposals are being solicited at this time for the Phase I study of the Union and Health Plan data processing requirements.

The Need for the Study

The United Farm Workers Organizing Committee (UFWOC), led by Cesar Chavez, has been attempting to secure better working conditions and greater economic security for farm workers through collective bargaining. The Union provides several services and benefits to its members, including Union Hiring Halls, a Death Benefits Plan, and a Credit Union. The RFK Health Plan also provides medical and death benefits for farm workers. To administer these services efficiently, the Union must keep accurate records for each member, including his dues history and membership status. The Union must collect and account for dues, voluntary donations, and growers' contributions to an Economic Development Fund for retraining members. The Union also administers credit union accounts, and keeps track of contract provisions and job availability. The RFK Plan must maintain records of hours worked, beneficiaries and process benefit claims.

These data processing tasks are difficult because:

- The majority of Union members are migrant workers who move from job to job over a large geographic area.
- Many members are not fluent in English and have

little formal education or experience with Union membership.

- Almost all of the record keeping is being performed manually by staff members, who are volunteers receiving a small living allowance.
- The Union is supported in large measure by contributions from sympathetic individuals. It does not have the financial resources to hire a large staff or invest in expensive equipment.

In recent months the Union and Health Plan have experienced a sharp increase in membership resulting from the successful conclusion of a nation-wide grape boycott and the signing of Union contracts with major grape growers. Further increases in membership are anticipated from negotiations currently being conducted with producers of lettuce, strawberries, and other crops. This growth in membership has placed a serious strain on the capacity of the Union and Health Plan to maintain timely and accurate records using their current procedures. The purpose of the proposed study, then, is to determine:

- How long the Union and Health Plan can expect to keep up with the increasing paperwork using current methods
- Whether there are better manual methods which could be used to process the paperwork more efficiently
- Whether the Union and Health Plan should plan now to change to some form of automated record keeping using a computer or other device
- If the Union and Health Plan should use computer processing, what kind of a computer is necessary, what should it do, and what will various alternatives cost?

Proposed Requirements

Your proposal should be for a study of the information processing requirements of the United Farm Workers and RFK Memorial Health Plan, to be completed by December 31 of this year. Output from the study should be in the form of a written report recommending whether or not the Union and Health Plan should proceed with the development of a computerized data processing system. The report should include sufficient detail on all of the present data processing activities so that the initial design of

such a system could be completed by working solely from the report.

Special consideration should be given to the fact that the Union is dependent upon volunteers to staff the Union headquarters. Many of these volunteers have been field workers, and, while they may have had little or no previous contact with EDP, they do have a spirit and dedication to the Union's cause which is vital to its continued success.

Specifically, your proposal should include:

1 What data you plan to collect, and how you plan to collect them

2 A research plan showing a time schedule for each step in the study

3 What demands the study would place upon Union personnel and/or facilities

4 The number of people from your firm who would be involved in the study

5 An estimate of the total number of man-days required for the study, and estimated expenses.

Some further background information about the United Farm Workers Organizing Committee and RFK Health Plan is attached to assist you in preparing your proposal.

APPENDIX: Background Information

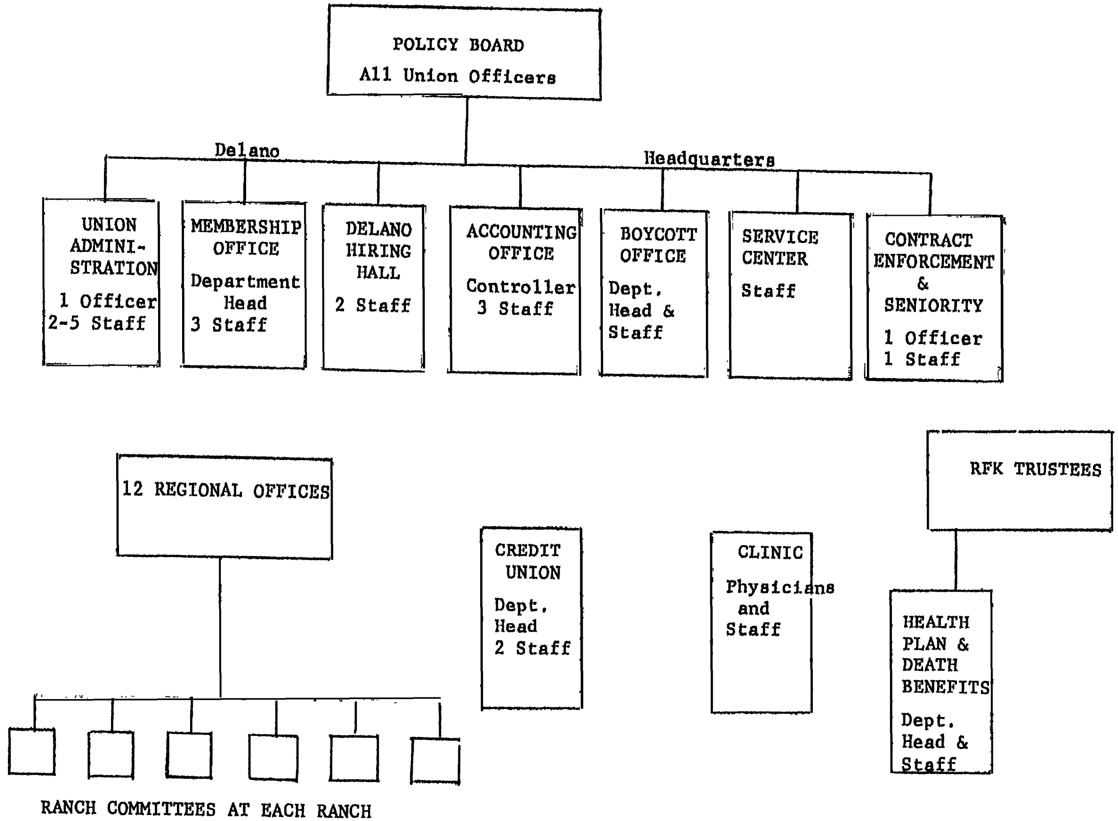
Overall Organization

The overall organization of the Union and Health Plan is shown roughly in the attached organization chart.

The Board consists of all of the officers of the Union and meets as necessary to decide all matters of policy. The Union's administrative headquarters are in Delano, California. The Delano headquarters has several departments, shown in Exhibit 1. In addition there are boycott representatives in 70 cities in the U.S. Directing the work of these representatives is the responsibility of the Boycott Office. Budgets for these activities are administered by the accounting department. There are also 11 hiring halls in various other locations which essentially serve three functions:

Exhibit 1

UFWOC & RFK MEMORIAL HEALTH PLAN (A)



1 as membership offices where new members may join and old members may pay dues, ask questions, etc.

2 as hiring halls, dispatching members who are available for work to jobs which are available at ranches in that area.

3 as administrative centers for the Ranch Committee at each ranch.

A Ranch Committee consists of Union members from each ranch who are elected by all of the members working at the ranch. The function of the Ranch Committee is to decide questions of seniority, handle grievances, distribute information to Union members, and ensure that the contract is being enforced.

The Robert F. Kennedy Health Plan is an independent entity administered by a Board of Union and Employer Trustees. The Plan is financed primarily by employer contributions, and members not covered may participate by paying a small fee.

Union Membership Office

The central Membership Office in Delano is responsible for maintaining a current dues history for every Union member. This is done by manually posting the amount of dues paid on an 8-1/2" x 11" Master Card which is filed by Social Security Number (Exhibit 2). Members who are not working under a Union contract pay their dues in person at Delano or one of the regional posting, and a yellow dues card which the member carries with him is updated. Members working under Union contracts have dues deducted monthly from their paycheck by the growers. The growers in turn remit these dues to Delano, along with a list of the workers and the amounts deducted for each one. Posting is done manually from these lists.

A member working under Union contract and whose dues are checked off by the grower can only have his yellow dues book updated by taking a check stub showing the dues deducted to the local hiring hall. Since a member must have his back dues paid up and/or must sign an authorization for dues to be deducted before he is dispatched to a job, it is important that his dues history be accurate. Problems sometimes occur because a grower is late in submitting his list of dues and/or the member does not

Exhibit 2
UFWOC & RFK MEMORIAL HEALTH PLAN (A)

Social Security Number	Last Name	First	Middle
Date of Birth	Home Address	P.O. Box	City
Cross Reference			

Membership Date ____
Initiation Date ____
Application File ____

Suspension	Reinstatement

RECEIPTS												
CASH			CHECK OFF									
Amount	Rct. No.	Date	Amount	Ranch	Date	Dues	Asses-ments	Initi-ation	Reinsta-tement	Fines	Other	

DUES MONTHS

19	19	19	19	19	19	19
Jan	Jan	Jan	Jan	Jan	Jan	Jan
Feb	Feb	Feb	Feb	Feb	Feb	Feb
Mar	Mar	Mar	Mar	Mar	Mar	Mar
Apr	Apr	Apr	Apr	Apr	Apr	Apr
May	May	May	May	May	May	May
Jun	Jun	Jun	Jun	Jun	Jun	Jun
Jul	Jul	Jul	Jul	Jul	Jul	Jul
Aug	Aug	Aug	Aug	Aug	Aug	Aug
Sept	Sept	Sept	Sept	Sept	Sept	Sept
Oct	Oct	Oct	Oct	Oct	Oct	Oct
Nov	Nov	Nov	Nov	Nov	Nov	Nov
Dec	Dec	Dec	Dec	Dec	Dec	Dec

ASSESSMENT MONTHS

Jan	Jan	Jan	Jan	Jan	Jan	Jan
Feb	Feb	Feb	Feb	Feb	Feb	Feb
Mar	Mar	Mar	Mar	Mar	Mar	Mar
Apr	Apr	Apr	Apr	Apr	Apr	Apr
May	May	May	May	May	May	May
Jun	Jun	Jun	Jun	Jun	Jun	Jun
Jul	Jul	Jul	Jul	Jul	Jul	Jul
Aug	Aug	Aug	Aug	Aug	Aug	Aug
Sept	Sept	Sept	Sept	Sept	Sept	Sept
Oct	Oct	Oct	Oct	Oct	Oct	Oct
Nov	Nov	Nov	Nov	Nov	Nov	Nov
Dec	Dec	Dec	Dec	Dec	Dec	Dec

NOTES

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retain his check stubs to prove that he is up to date in his payments.

An alphabetical cross-reference file is maintained to locate members when the social security number is not known. At the present time there are about four full-time workers in the Delano Membership Office. Physical space is limited, and members of the department must answer questions about member status and receive dues payments as well as post dues from the growers' lists.

Union Accounting

The Accounting Office is primarily responsible for administering the Union's budgets. The Accounting Office receives and verifies all incoming funds, keeps track of deposits and bank reconciliations, prepares and administers budgets, processes bills and issues checks, and prepares all necessary state and federal reports. All of the bookkeeping and accounting is done manually by the Union controller and three other workers.

Union Seniority and Contract Enforcement

This office has the general responsibility for seeing that all contract provisions are met, and for determining questions of seniority. At the present time most seniority questions are settled at the Ranch Committee level. The details of a Union-wide seniority plan are still being worked out.

Service Center

The Service Center, which is supported almost entirely by voluntary contributions, provides additional services to farm workers, such as legal and consumer advice.

Credit Union

Membership in the Credit Union is available to Union members for maintaining savings and obtaining low-interest loans. It is administered in compliance with state laws governing all credit unions, and all of the record keeping and processing is done manually by three members of the Union staff.

Exhibit 3

UFWOC & RFK MEMORIAL HEALTH PLAN (A)

Social Security Number	Code	Code	Code	Last Name	First Name	Middle Name	Card Date

Home Address	P.O. Box	City	State

Birthdate	Married	Number of Children

Month	1 Balance	Hours	2 Balance	Wdrawl	Bank	Over	Category	Eligibility	Notes

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Robert F. Kennedy Health Plan and Death Benefits Plan

The Union has negotiated a Health Plan which pays for certain medical costs incurred by eligible members, and a Death Benefits Plan which provides a payment to the family of an eligible member in the event of death. Eligibility for health benefits is determined by the number of hours a member has worked under Union contract during the previous quarter. The Health Plan office maintains a record of these hours for each worker which is updated by posting hours to an 8-1/2" x 11" Master Card from lists submitted by the growers (Exhibit 3).

The Health Plan is funded by contributions from the grower based upon the total number of hours worked at his ranch by all Union employees during the month. The plan is jointly administered by six trustees, three of whom are growers and three of whom are Union officers. The Health Plan office is responsible for receiving and accounting for all payments by the growers, and for processing all claims made under the plan. The office also processes all claims made under the Death Benefits Plan. (The Union maintains a separate death benefit plan for workers not covered by the Kennedy Plan.) At the present time there are four full-time workers in the Health Plan office who do all of the posting, claim processing, and answering questions about the plan and members' eligibility.

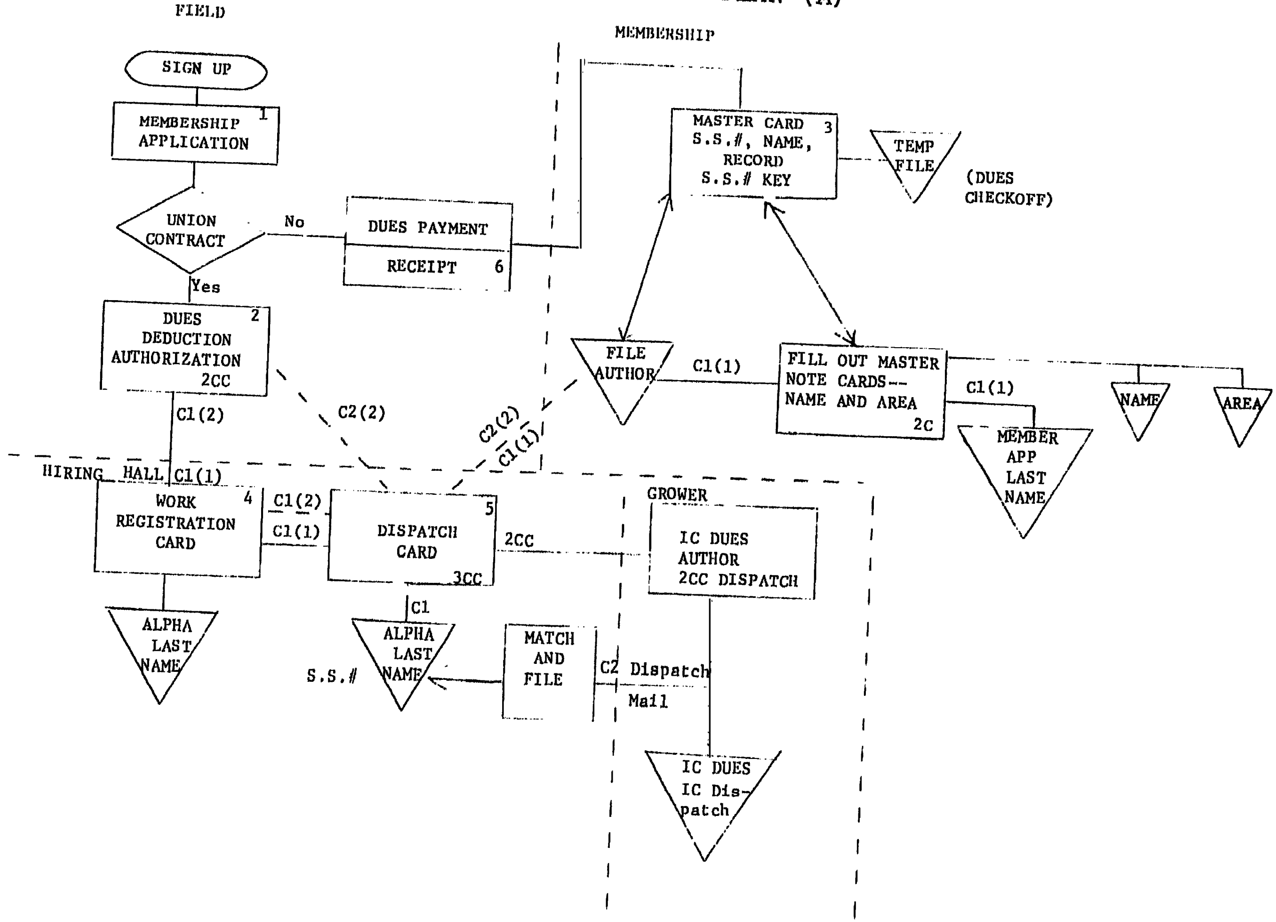
Clinic

A medical clinic has been established in Delano to provide out-patient care to Union members in the area. The clinic is run by physicians and registered nurses, and other assistants. If the medical service provided is covered under the Health Plan, the clinic files a claim with the Health Plan and receives payment from the plan. All medical records are maintained manually by the clinic staff. The clinic itself does not keep any record of members' eligibility under the Health Plan, but relies on the record kept by the Health Plan office.

Flowcharts

High-level flowcharts of the major data processing activities are presented in Exhibits 4-8.

Exhibit 4
UFWOC & RFK MEMORIAL HEALTH PLAN (A)



UFWOC & RFK MEMORIAL HEALTH PLAN (A)

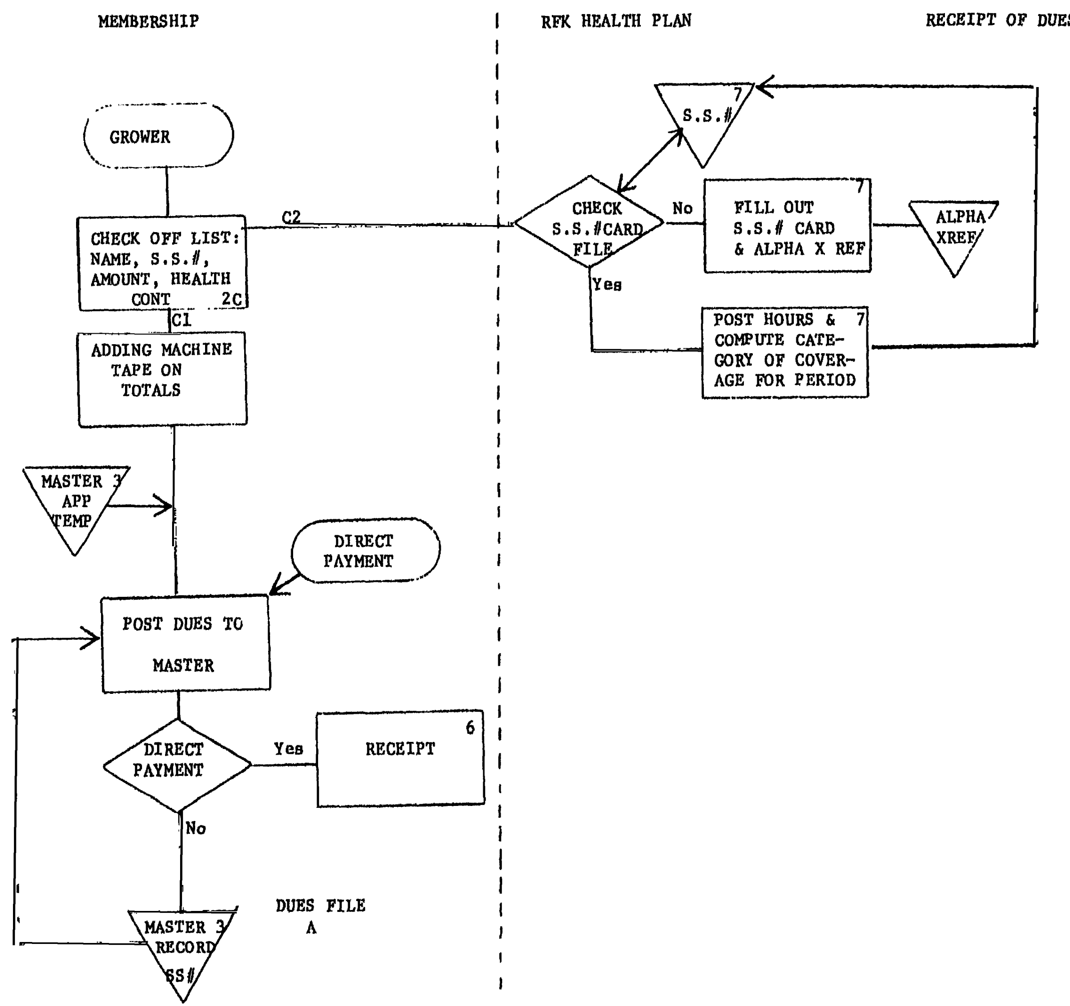


Exhibit 6
UFWOC & RFK MEMORIAL HEALTH PLAN (A)

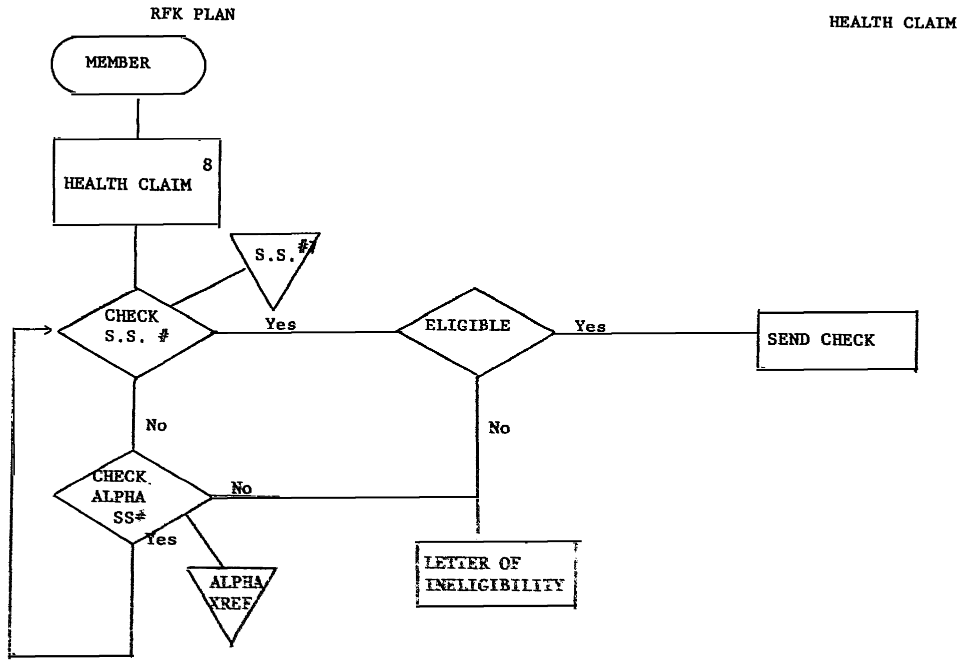


Exhibit 7

UFWOC & RFK MEMORIAL HEALTH PLAN (A)

MEMBERSHIP OFFICE

DEATH BENEFIT CLAIM

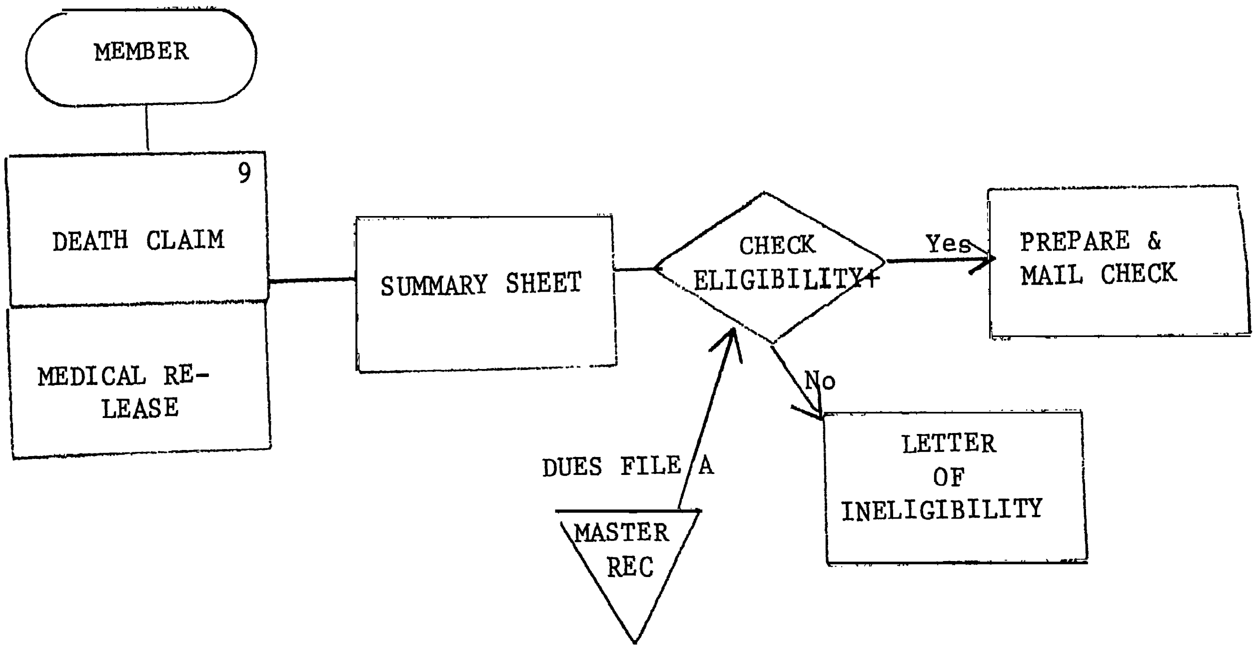
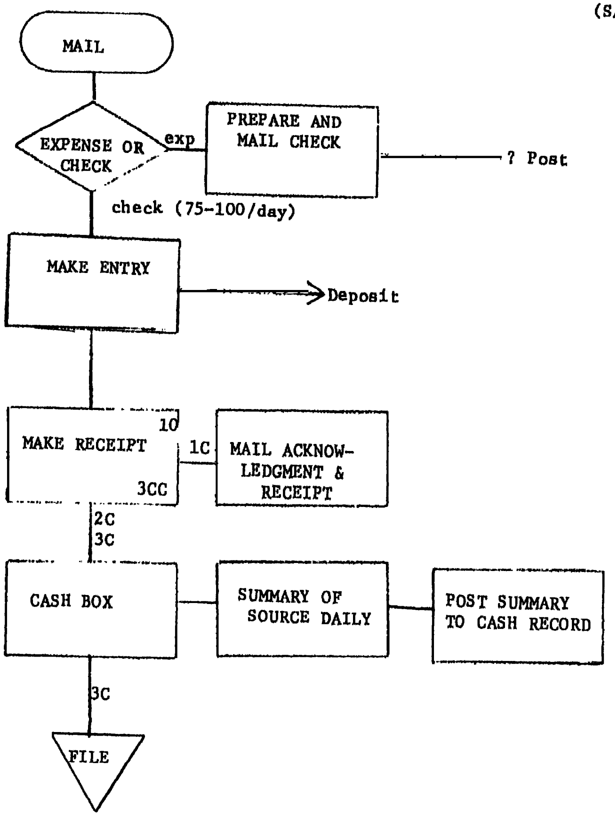


Exhibit 8
UFWOC & RFK MEMORIAL HEALTH PLAN (A)

ACCOUNTING?

DEFENSE FUND ACCOUNTING
(SAME FOR ADMINISTRATIVE FUND)



Carver Consolidated Products (A)

F. Warren McFarlan

In March, 1967, the manager of the Consumer Paper Products Division of Carver Consolidated Products Company was concerned about inventory and distribution management. He asked Mr. Roger Halverson, corporate director of Management Information Systems, what assistance his department could provide in developing a solution to the distribution and inventory problem in Carver's Amhall plant, which manufactured greeting cards.

Industry Background

The greeting card industry has a history of over 100 years of operation in the United States. The industry's major firms were founded around the turn of the century and the leading trade source, the Greeting Card Association, was formally organized about 25 years ago. It is estimated today that over 250 firms are in the industry.

The principal outlets for greeting cards are stationery, department, variety, chain and drug stores. Often, particularly in drug store outlets, one greeting card company will have the exclusive on selling to an individual outlet or chain. Rarely are more than three or four companies servicing the same outlet. Depending on the outlet's size, it may carry 200 to 1,200 different card styles at one time. It is accepted practice for a salesman or service representative to visit accounts and remove slow-moving items, together with soiled and damaged cards, and to replace them with new merchandise and new designs at no expense to the retailer. The theory is that a profitable account is not just one which displays cards, but one which sells them.

The lead time required for design, manufacturing, and final distribution of the cards at the retail level averages 18 months for seasonal cards. Since seasonal cards account for about 60 per cent of total industry

sales, working capital requirements in the form of raw material costs, receivable financing for customers, and labor costs are usually high in relation to style. The seasonal aspects of the business place a premium on very tight inventory control; either over- or under-production can be very costly in terms of stored (often obsolete) inventory, or lost sales. Greeting cards are high-style items and the salability of any one style drops markedly from one year to the next. Quick reaction to customer needs is also essential.

All major companies have initiated the use of electronic data processing as a market-analysis tool, to improve service on accounts and to reduce costs through better control over inventory and other expenses. Sales reports and recorders can be compared against past records to show how well an account is doing. Hitherto unobtainable sales statistics are currently being gathered to provide better inventory control, and more information on marketing, sales research, and accounting. Substantial computer applications have also been implemented in the production and production-control areas, because of the huge number of different cards involved and the many stages in the manufacturing process.

Carver's Amhall Plant

In 1967 Carver was in its ninetieth year of operations. In 1966 sales had reached a record total of 540 million dollars, up 100 per cent from their level just three years earlier. A[s a] multidivision company, much of this growth had been accomplished through acquisitions. In 1964, as part of the firm's expansion into the consumer paper products area, Carver had acquired Amhall, a small manufacturer of seasonal greeting cards, with annual sales of around 14 million dollars.

The Amhall plant, with its headquarters and manufacturing facilities near Chicago, was in its thirtieth year of operation. Concentrating primarily on the creation, production and distribution of Christmas, Valentine and Easter cards, almost from the beginning, Amhall had been the source of special management concern and problems to Carver. Although it maintained a small everyday line (birthday, anniversary cards, etc.), 80 per cent of its business was in its seasonal lines. These lines were sold by a group of approximately 120 salesmen supervised by 7

divisional sales managers, organized into two regions, reporting to Chicago. This sales force also handled paper plates and novelty items manufactured by another plant in the Consumer Paper Products Division. The sales force was currently handling some 6,000 different store locations.

There were about 2,500 card styles in the Christmas line and about 1,000 styles each in the Valentine and Easter lines. These cards were grouped into various "price-title" categories. Some price-title categories contained only a single card style, while others contained 30 or more. For example, in the 1967 Valentine line, there were 28 "$.25-general-purpose" card styles but only one "$.50-to-my-favorite-nephew" card style. The 1967 Christmas line has 700 price-title categories; the Valentine and Easter lines each had about 250.

The Amhall plant had extensive experience with data processing. Starting with an IBM tab installation back in the 1940's, it had acquired an IBM 1410 in 1959, a 360/40 in 1965, and was one of the first companies to install a 370/138, which was currently running about 200 hours a month. Principal applications included payroll, billing, accounts receivable, and preparation of invoices. With a systems and programming staff of seven, the EDP group was aggressively seeking new applications. There were no plans at present to use this equipment to support the activities of any other plant in the company.

The Order-Entry System

One of the principal applications was in order-entry and invoice preparation for the seasonal lines, described briefly below. Customers' seasonal orders were processed as follows: The salesman filled out one of two types of order forms for a customer, a "style-number" order form or a price-title order form. The style-number order form was used when the customer wished to select (from an order catalogue) the individual card styles to be carried in his store. About 15 per cent of the orders were currently of this type. The price-title order form was used when the customer did not wish to involve himself in the detailed process of selecting individual card styles, but merely wanted to specify the number of cards in each price-title group he wanted to carry.

Not infrequently, in practice, the customer and salesman negotiated a total dollar value for the order and

the salesman was left with the responsibility of allocating the dollars among the various price-title categories. In doing this he took into consideration such factors as:

- his general experience about which price-title categories were apt to move well in a particular style of retail outlet; and
- the amount of merchandise left over from the last season in the various price-title categories in the customer's store.

In all but 15 percent of the accounts, the customer took full title to the merchandise at the time it was received. Consequently, at the end of the Christmas season, he often stored the leftover merchandise until the start of the next season, when it was again put on display.

When an order form was received in the Chicago office, it was logged in on a register, stamped with an order number, and then sent to the pre-billing room. The pre-billing room had two huge tub files containing punched cards, and was manned by two shifts of six clerks each. One tub file was used to service style-number order forms, and the other to service price-title order forms. The procedure for processing these forms was as follows.

Columns	1- 5	Style Number
	6-20	Alphabetic Name of Style
	21	The Number "1"
	22-28	Unit Price of Style
	29-35	Warehouse Slot Location of Style

A clerk took the order and went to the style-number tub file. The tub file had as many pockets in it as there were style numbers in the line. On the front of each pocket was glued a label indicating the style number it

held. In the pocket were a large number of prepunched IBM cards, each of which represented one box of greeting cards. The format of the cards was as follows:

Columns	1- 8	Invoice Order Number
	9-14	Customer Number
	15-30	Customer Name
	31-36	Date Order Received
	37-42	Date Shipment Requested
	43-51	Total Dollar Value of Order
	80	An 11-Punch

The layout of the pockets in the tub file conformed to the layout of the order form. For example, the pocket on the upper left contained IBM cards representing the first item on the order form, the pocket directly under it contained IBM cards representing the second item on the order form, and so forth. In this way a clerk could quickly pull the appropriate IBM cards to fill the order. For example, a clerk noting that three boxes of style 10123 were ordered would reach into the pocket labeled 10123 and pull out three IBM cards. If the next item on the order were two boxes of style 202, she would then advance to the pocket labeled 202 in the tub file, and pull two cards. When she had pulled cards for all the items in the order (not infrequently more than 1,000) she placed them behind the keypunched card and sent the group to the computer room for processing. The order form was then filed away and she started on another order. It should be noted that there were always enough prepunched IBM cards in the tub file so that the clerk never had to worry about not being able to find a card for each item requested on the order form.

<u>Price-Title Order Forms</u>

A keypunch operator punched a card in the same format as described above. A clerk took the order to the price-

title tub file. This tub file was laid out by price-title group in the sequence they appeared on the order form. Under each price-title group were arranged labeled pockets. Each pocket contained punched cards for a style number in that price-title group. These cards were of the same format as described above. There was one pocket for each style in the group. If three card styles were ordered from a price-title group, the clerk took one card from each of the top three pockets in the group. If more designs were indicated than there were styles available, after she had reached the bottom pocket of that price-title group, she simply started from the top again. This was unusual, however, since in addition to the new styles for a season, there were also quantities of items left over from other seasons. They were called carryover items, and punched cards recognizing their existence were also in the tub file, under the appropriate price-title groups. When she had pulled cards for all the items on the order, they were put behind the keypunched card and sent to the computer room for processing. There were always enough of the prepunched item cards in the tub file so that the clerk did not have to worry about not being able to find a card for each item on the order.

The way in which the cards were sequenced under the price-title code in the tub file was an important managerial decision. The higher an item was in the price-title grouping, the more it was going to be sold. The decision about sequence was received every two weeks. The principal inputs to this decision were the quantity of the item that had been ordered, and its original production schedule.

The decks of cards which accumulated in the computer room were read onto magnetic tape once a day. The orders on this tape were then sorted into shipping date sequence. This file was then merged with a master file which contained all previously received, unshipped orders, also sorted into shipping date sequence.

Usually once a week (in peak shipping times, however, as many as three times a week) this master shipping tape was put through a file maintenance run. This run removed such things as orders which had been cancelled and changed shipping dates, to comply with new customer instructions. After the maintenance run had been completed, the tape was processed as follows.

All orders due to be shipped during the following week

were taken off the tape, one at a time. During this phase, the items on the order were sorted into warehouse slot sequence (information carried on the tub file cards), and a "picking list" was prepared. This enabled the warehouse picker to fill the order by making only one trip around the warehouse. At the same point in processing, a detailed invoice was printed out. A new tape was also prepared, containing all the orders on the original tape which did not have shipping dates for the following week.

The picking list and invoices were then sent to the warehouse where the merchandise was picked, packed and shipped. Normally two to five working days elapsed between the time the picking list and invoice were prepared, and the time a warehouse picker used them to gather merchandise.

Operating Problems

Speaking about the effectiveness of this system, Amhall's controller said:

> It wouldn't be a bad system if only we were perfect forecasters and could get all of our products on into finished goods inventory before the start of a season. As it is now, both at the very beginning of the shipping season and from the middle on, warehouse pickers encounter situations where the items called for on an invoice are not available in the bins. There are two classes of problems here.
>
> One problem is that we have no finished goods inventory file. It is perfectly possible, therefore, for us to pull three times more IBM cards for a particular style than there are boxes available.
>
> Another problem is that a heavy shipping schedule at the beginning of the season may quickly deplete the available stock of a style, the vast majority of whose production has been delayed for three to five weeks for various technical reasons.

If it is a no-substitution order--and about 15 per cent fall in this category--we pull as much of the order as we can locate, cancel the rest, and then send the invoice to a clerk who retypes it manually. Last Christmas we got so badly behind retyping that we didn't ship 250 thousand dollars' worth of merchandise until after

December 20. Needless to say, most of it was returned to us unopened.

If it is a substitution-permitted order, then the warehouse man picks another item on the floor. Physical proximity in the warehouse to the empty bin is one of the key decision inputs the warehouse pickers use. The warehouse is laid out to expedite picking speed, and there is no guarantee that appropriate substitution items will be located near each other. With 110 of these people picking these orders, it is impossible to control the types of substitutions they make. Several customers called to complain that of the 400 boxes they received, 200 were of the same style.

We are in a position where key merchandising and product decisions are being made by 60-dollar-a-week pickers, with no way for management to influence them. Our customers need merchandise and are, in general, receptive to reasonable substitutions. We can make substitutions on an individual, special-order basis, but at present it is just too complex to try to do it on all orders. Unless our customer specifies that he wants more than one box of cards of a style, I am opposed to solving the problem of given stockouts by doubling delivery on those items we do have--hence, we must either find a substitute or cut the order.

Our merchandising department is capable of developing an elaborate set of decision rules, as to substitution, that we should follow. Examples of the types of rules they could develop are:

- No more than one box of each card style should be sent
- When we have run out of "$.25-uncle" cards, we should try "$.35-uncle" cards, then "$.15-uncle" cards, then "$.25-general" cards. If there are no available "$.25-general" cards, then drop the item from the order.
- We don't want to ship more than 15 per cent carryover merchandise on any order (Carryover items can be distinguished by the fact that the fifth digit on the style number of a carryover item is always 2.).
- We would like to be able to prepare back orders, so if we miss enough items on one shipment we can try later when our bins may be replenished.

At present, it is administratively impossible to implement such a set of decision rules. One of the reasons it

is so important to make progress in this direction stems from the extreme inflexibility of our production scheduling. Surprising as it may seem, our production schedules have to be locked down prior to the receipt of more than 5 per cent of the season's orders. Consequently, instead of matching production to demand, we are forced to fit demand to available inventory.

I am hoping that you can give me a handle, not only on how to solve this problem, but on how to cut our high paperwork costs. Do you know that our latest estimates indicate the cost of invoice preparations is nearly 10 dollars per invoice?

Assignment

1 Prepare a flowchart for a system which could be used to solve Mr. Halverson's problem.

2 In what areas would you like additional information? What management decisions other than the fundamental Go/No-Go ones are implicit here?

L. G. Wynant Company

Saumitra Sircar

The L. G. Wynant Company manufactures and sells supplies and equipment to bakeries, soda fountains, ice cream and confectionery manufacturers, restaurants and institutions in 13 northeastern and eastern states. The majority of the items in the product line are purchased for resale, but the company manufactures ovens and other bakery equipment and more than 100 varieties and flavors of food products.

The firm was founded in 1897 when Mr. L. G. Wynant set up shop in Boston as a wholesale grocer. A few years later he withdrew from the grocery field to serve the bakery trade exclusively. In the early 1900's his concern made the first commercial pie filling used in this country. Other fillings, jams and jellies were added in subsequent years.

The Wynant items are divided into three product groups as follows:

<u>Group A</u>

	Products made by the company (25% of total sales)
A-1	Jams, jellies, pie fillings and bakers' specialties
A-2	Soda fountain and ice cream supplies
A-3	Extracts
A-4	Powders and icing bases

<u>Group B</u>

	Products purchased by the company (70% of total sales)
B-5	Pie fruits, dried and glaced fruits and nuts
B-5S	Staple wholesale groceries (shortenings, cocoa, dessert preparations, teas, etc.)
B-6	Specialties (powdered milk, molasses, malt, spices)
B-7	Canned goods (fruits and vegetables)
B-8	Frozen goods

Group C	
	All products purchased by the company except C-9 (5% of total sales)
C-9	Ovens and other equipment
C-10	All small equipment and utensils
C-11	Motor driven machinery
C-12	Bakery furniture (showcases, tables, etc.)

The L. G. Wynant Company has done business with a substantial number of its 15,000 customers for many years. Its sales have been growing at 5% per year to a current annual sales volume of about $25,000,000. The 70 salesmen have regular routes and call on city accounts once a week, others either biweekly or monthly. They are paid "drawing accounts," which actually are minimum salaries, plus commissions based on gross profits from their sales. Fifty-seven salesmen operate out of Boston, while 13 salesmen are in the New York office. All sell the company's entire line.

In addition to the salesmen, a service staff of four specialists helps customers with their problems. A trained dietician works with restaurants and institutions. The other three are experts in problems encountered by either ice cream manufacturers, soda fountain operators or bakers.

The nature of the company's operations is reflected in the number of persons in the various types of jobs. Sixty-two work in manufacturing, which is all done at the Boston plant. Sixty are in warehousing and shipping. The company maintains warehousing facilities in both Boston and New York. Seventy are salesmen and 14 drive delivery trucks. The remaining 112 persons have administrative and clerical duties and account for 40 to 45 per cent of the payroll. Wages and salaries represent about 50 per cent of the company's total expense.

Three generations of the Wynant family have furnished company presidents. Upon the death of the founder in 1940, his son Mr. J. K. Wynant succeeded to the presidency. He became well-known also for his active participation in church, civic, philanthropic and business groups. In July 1974, he became chairman of the board of directors of L. G. Wynant Company and his son, Mr. J. K. Wynant, Jr., was elected president. The latter had been a salesman, sales

manager, vice-president in charge of sales and advertising, and a director since joining the company in 1950. He was in charge of the New York office for three years immediately preceding his election to the presidency. Eight executives currently report to him. Exhibit 1 contains a company organizational chart.

The Order Processing Cycle

The company's procedures for running the business have remained virtually unchanged since 1950. Most of the operations connected with handling orders and preparing reports are performed manually. Upon taking an order, the salesman fills out an order blank, original and three copies. Descriptions of the items are written by hand.

The salesman forwards the order to the company's office in Boston. The routine procedure leading to the shipping of goods and the preparation of the invoice and sales reports follows:

1 Mail Desk. Between 400 and 500 orders each day are received, sorted and routed.

2 Register Desk. A register number is placed on the original and first copy of the order and entered in a running record. The first copy of the order is filed.

3 Credit Department. All orders are either approved or rejected for credit. For each new customer, credit information is entered by the salesman on the special form printed on the reverse side of the order blank.

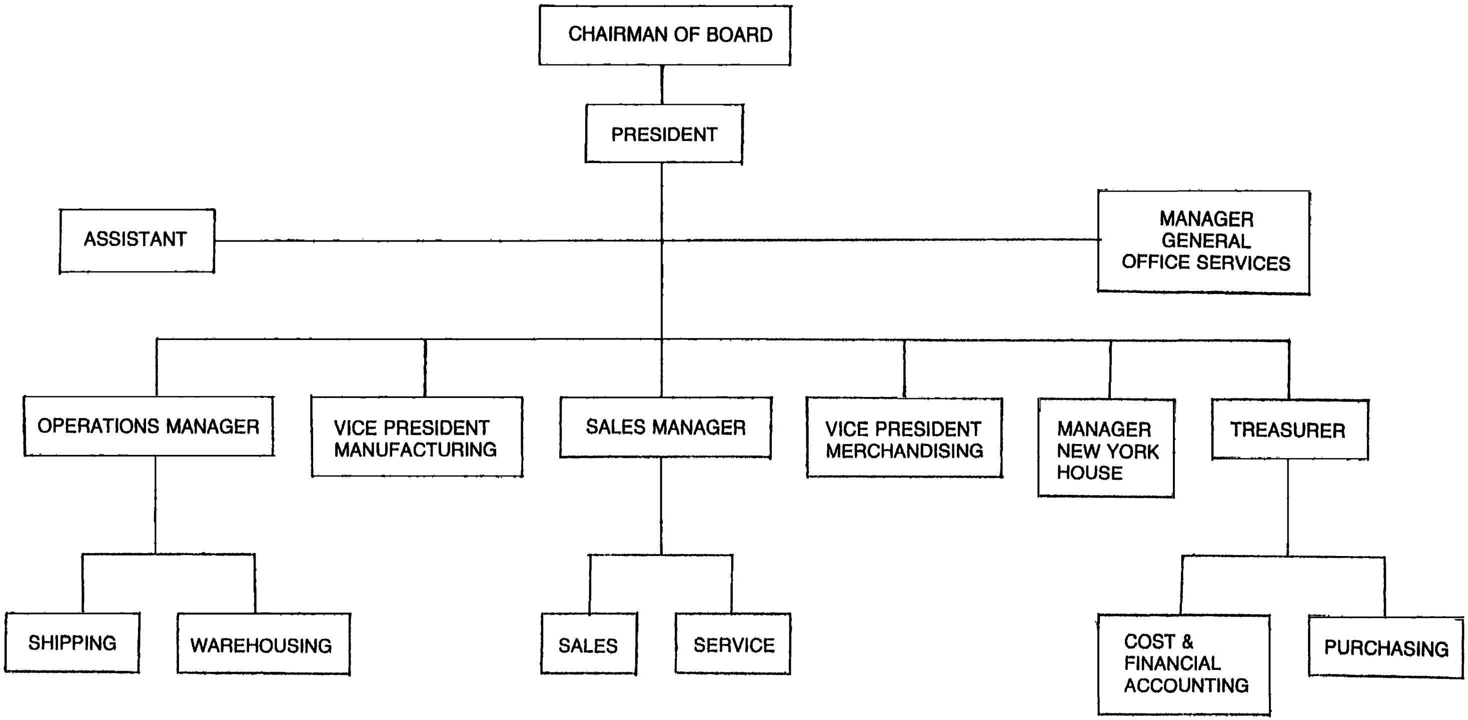
4 Pricing Desk. Prices which have been filled in by the salesman are checked. Orders for merchandise on which special prices have been quoted by salesmen, and orders involving contracts, are sent to the appropriate product department head for approval. The original and two copies of the order are sent to the shipping department for use in the selection of the merchandise in the warehouse.

5 Shipping Department. Commodity detail cards are pulled from the inventory control file or "tub file." This file, in effect, is a miniature warehouse in that each card represents a shipping unit of merchandise actually in the warehouse. Cards are added to the file when merchandise is received and removed when goods are shipped. Merchandise is selected from the warehouse using the pulled commodity detail cards and shipped on either the same day the order is received or the day following. If any items

Exhibit 1

L. G. WYNANT COMPANY

Organization Chart



ordered cannot be sent because of out-of-stock conditions or other reasons, a note to that effect is made on the order form so that it constitutes a record of what actually is shipped.

The original and two copies of the order are sent to the billing department.

6 Billing Department. The invoice is prepared in triplicate, price extensions are checked, and the bill of lading is prepared. The original copy of the invoice is mailed to the customer. The first copy is sent to the sales department, where it is filed by customer in the permanent duplicate bill file, after the sales total has been posted to a Kardex record of sales by salesman by account. The second copy goes to the costing department.

7 Costing Department. The cost of the merchandise ordered is filled in on the second copy of the invoice. In this connection, changing prices of goods bought for resale creates a problem of timing changes in cost figures. The costing department does not know exactly when the goods bought at the old price are cleared from inventory and when merchandise bought at the new price is being used to fill orders. Estimates are made which are subject to error but believed to be reasonably accurate in most cases.

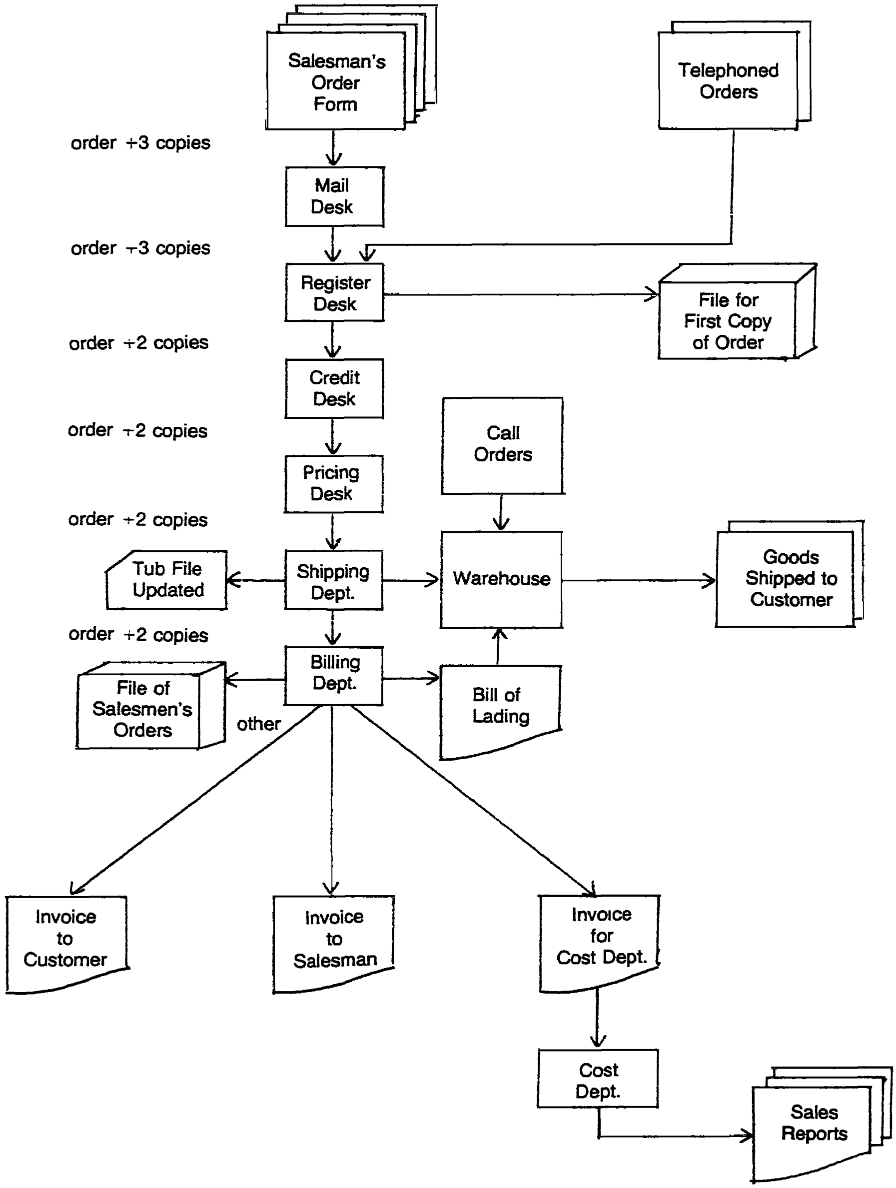
A flow chart of the order processing cycle is shown in Exhibit 2.

Inventory Control

A perpetual inventory is kept to reflect each movement of stock, unit by unit, so that inventory balances are available for use by production, buying and costing. To provide effective inventory control, it is necessary to have information on what is received, what is shipped and what is on hand readily available.

The tub file of commodity cards was designed to give a quick picture of the stock situation in the warehouse. The file is divided into many sections, one for each item in the product line. Cards are placed in the file end-up so that the code numbers and serial numbers printed across one end can be read. A code number identifies all cards representing the same item. Serial numbers running from one up are printed when cards for a given item are prepared on the receipt of an incoming shipment of merchandise. The cards are placed in the appropriate tub file section

Exhibit 2
L. G. WYNANT COMPANY
Flow Chart of Order Processing Cycle



so that the lowest numbered card is in front. New cards representing later receipts are inserted in front of the cards already on file. Therefore, each section of the file might contain several groups of cards for the same item, each serially numbered. Each group is separated by high divider cards. When a card is needed for the filling of an order, the one at the back of the section is taken.

When only one shipment group of cards is in the file for a given item, the inventory can be read simply by referring to the highest numbered card. If several groups are present, the highest numbers of each of the groups are added to give the inventory. The current inventory reading subtracted from the previous inventory total plus any receipts gives the quantity shipped during a period.

"Time to buy" signals, consisting of "minimum," "danger," and "out-of-stock" cards of different colors, are inserted at selected points in each division of the tub file. The signal cards are removed when they are encountered as commodity cards are pulled to fill orders. These signal cards are either sent to the buyer directly or listed by a tabulating machine to prepare a time-to-buy report for the buyers.

The commodity card inventory control system has been installed for all items except equipment. The tub file on the New York stocks are maintained in Boston. After shipping an order, the New York house sends the order form to Boston for processing and billing. The Boston and New York offices are in contact with each other daily by telephone.

Management Control System

Management keeps track of the business through the medium of daily sales reports. These are prepared manually from the costed invoices, by tabulating total sales by departments and by salesmen. Monthly breakdowns are also prepared of sales and gross profit by departments, by salesmen, and by salesman by department.

These reports are distributed to the chairman of the board, president, vice-president in charge of merchandising, vice-president in charge of manufacturing, treasurer, sales manager, operations manager and the 15 product department heads who have merchandising and buying responsibilities. When the system runs smoothly daily sales reports are available three to four days after the orders

are received. However, delays in this schedule are frequent because of numerous difficulties encountered in running the business. Many mistakes are made in handling orders--errors in merchandise shipped, errors in billing, delays in shipments and delays in the receipt of bills. Complaints are frequent from irritated customers and there is little doubt that the company suffers because of customer dissatisfaction.

Some of the major reasons for the problems are as follows:

1 Illegible orders sent in by salesmen cause much trouble in the office and delay shipping and billing.

2 Out-of-stock conditions at the tub file are a major cause of held-up orders. These occur because the tub file is inaccurate for any one of several reasons. Sometimes receipts of goods by the warehouse are not reported promptly, or commodity cards are not added to the tub soon enough to prevent an out-of-stock condition from being shown when goods are available. As a result, shipments were either unnecessarily delayed or orders are shipped short.

It is also common for the tub file to show items as being in the warehouse when an out-of-stock condition exists. One explanation is that demand for a number of the products manufactured by the company is so great that very little inventory has been built up. Some items are virtually shipped "hot." When orders for such merchandise are received and the tub file shows no stock on hand, it is customary to ask manufacturing how many units could be ready later that day. If the answer is 10 for a given item, that number of commodity cards is added to the tub file and orders are processed on that basis. However, the manufacturing estimate sometimes prove to be inaccurate. Perhaps only 5 units, rather than the estimated 10, actually reach the warehouse. In the meantime, 10 orders for the product may have been processed. As a result, orders for 5 units are either delayed or shipped short.

Call order business also leads to discrepancies. About 25 orders a day are received from customers who personally call at the plant for merchandise. These orders are filled as promptly from the warehouse as possible and, because the number of call orders is small, are allowed to accumulate before being forwarded to the inventory control section.

This means that the tub file is "long" on some items in the interim.

3 Special instructions, which accompany about 10 per cent of the orders, are a source of errors. Sometimes customers ask that their bills be prepared on special forms instead of the usual invoice blank. The majority of special requests, however, are shipping or delivery instructions which are to be reproduced on the invoice and also on the bill of lading. Lengthy instructions have to be edited to fit into the space allotted for them on the invoice card, and this sometimes changes their meaning. For example, a New York City restaurant which did most of its business during the lunch hour rush made this request on its order: "Don't deliver between 12 and 2 P.M." In preparing the bill of lading, the clerk omitted the first word. As a result, the instructions printed on the invoice read: "Deliver between 12 and 2 P.M." In attempting to carry out the order, the truck driver met angry resistance. The restaurant manager promptly made his displeasure known to the Wynant Company in a one-sided telephone conversation.

4 Mistakes in selecting and packing merchandise occur occasionally. One of the reasons for this is that stock pickers usually locate the bins from memory. There are no item numbers to counter check, and the bin numbers corresponding to each item are rarely written down by the stock pickers.

5 One of the most serious problem areas is pricing. Many of the items Wynant buys for resale are highly price sensitive to forces of supply and demand in the market place. Since profit margins on most of these products are wafer-thin, it is important that information on new prices be transmitted quickly to all salesmen, the pricing desk and the billing department. The purchasing department attempts to do this by means of a daily memorandum to all concerned, but unfortunately the price for a single item often differs from department to department. Still other errors arise from failures to note that certain orders call for special prices, and failures to use the proper discounts to the various classes of trade.

Purchase of an IBM System/3 Computer

Shortly after Mr. J. K. Wynant, Jr., took over as president of L. G. Wynant, a team of IBM salesmen was able to con-

vince him that a computerized information system was the answer to his problems.

IBM had developed a relatively inexpensive general-purpose computer system especially for small companies which had no computer experience. This system, known as the System/3, had captured a significant chunk of the small business computer market. IBM claimed that the System/3 was particularly well-suited to the following business applications:

- Order Writing
- Billing
- Accounts Receivable
- Accounts Payable
- General Ledger
- Inventory Control
- Payroll
- Sales Analysis

After a study of Wynant's operations, the IBM sales team recommended the System/3 Model 10, at a purchase cost of $85,535 or, alternatively, a monthly rental of $2,019. A breakdown of the cost is provided in Exhibit 3. A description of each of the items in the proposed system is given in the Appendix. In addition to this expense, the acquisition of the System/3 would require some additional personnel and also a room to house the installation. IBM's personnel recommended that Wynant hire a systems analyst and computer operator with experience in using the System/3. The salary of the analyst was estimated at about $1400 a month and that of the operator at about $900 a month. They recommended that additional personnel needed, such as keypunchers, should be retrained from existing clerical staff.

Wynant was fortunate to be able to make available a 20' x 18' room within the administrative building, which was larger than the 300 square feet required to accommodate the System/3 and the EDP department. The location had adequate security and was close to the people that were to be served--the treasurer's office, sales and operations. The System/3's power requirements of 60 cycles, 208-230 volts, presented no problem.

Modified Order Processing Cycle

To facilitate computerized operations, the routine procedure

Exhibit 3
L. G. WYNANT COMPANY
System/3 Model 10 Prices

Model/feature		Monthly rental	Purchase cost	Monthly maintenance	Purchase option first year discount
5410	16K processing unit including:	$ 685	$28,540	$ 88	45%
	5203 100 line per minute printer attachment	58	3,100	10	
	4100 multi-card function attachment	84	4,450	14	
	5471 printer keyboard attachment	53	2,965	5	
5203	Printer including:	243	11,230	67	40%
	36 additional print positions	79	2,380	2	
5424	Multi-function card unit	286	10,010	140	35%
5444	Disk storage drive	270	10,280	47	45%
5471	Printer keyboard	106	4,980	32	40%
5496	Data recorder	155	7,600	54	40%
		$2,019	$85,535	$459	

for handling orders would be modified according to a proposal submitted by the computer salesman to Wynant's management. Under the new system, writing up an order would be a simpler task. Only the original and one copy would be required and code numbers would replace handwritten descriptions of merchandise. The order form would be redesigned so that all entries pertaining to the customer and the price, quantity and code number of each item ordered could easily be made (see Exhibit 4). Every Friday, the computer would print a "price book" for the following week, containing the descriptions of each item the company sold, its price and code number. All the items covered by a single order form would be entered in code number sequence. A copy of the price book would be carried by each salesman and department.

It was also proposed that every bin and shelf-space in the warehouse would be assigned a warehouse slot number. This number would indicate the row and aisle in which each item was located and would simplify the stockpickers' task.

According to the new set-up, processing of orders at the company office would involve the following steps:

1 Mail Desk. Orders would be received, sorted and routed.

2 Order Desk. Telephone orders would be received in addition to the orders from the mail desk. Invoice numbers would be placed on both the original and the copy of each order. The duplicate would be placed in the register file and the original sent to the credit department.

3 Credit Department. All orders would be either approved or rejected for credit. This step would be made considerably easier by the existence of a daily Accounts Receivable report, generated by the computer, from its Customer File. The Customer File, kept on the Disk Storage Drive (see Appendix), would contain such items as customer account number, name and address, accounts receivable, and sales information. Exhibit 5 shows the layout of a customer record on Disk.

4 Pricing and Editing. Each order would be checked to see that it was filled out correctly. Prices would be checked from the price book but price extensions would not be computed because the calculations would be performed by the computer. When special pricings made by the salesman and contracts were involved, the order would be sent

Exhibit 4

L. G. WYNANT COMPANY
Order Form

Salesman Number	Our Order Number	Customer Order Number	Order Date	Customer Account Number	Date Required	Invoice Number

Sold to [ ]

Ship to [ ]

SHIPPED VIA		TERMS	

ITEM NUMBER	DESCRIPTION		QUANTITY			UNIT PRICE	EXTENSION
		PACK & SIZE	ORDERED	SHIPPED	B/F or CANCELLED*		

B/F or cancelled refers to bringing forward (back ordering) or cancelling part of an order due to an out-of-stock condition.

Exhibit 5

L. G. WYNANT COMPANY

Layout of Customer Records on Disk

Type	Account =	Customer Name	Address

City & State	Zip	Credit	Terms Extended	Business This Period	Business Last Period	Date of Last Order	Total A/R Outstanding

Date Last Payment	Aged Outstanding Accounts Receivable			
	Current	30-60 Days	60-90 Days	>90 Days

Source: IBM System/3 Disk System Introduction Form GC21-7510-0.

to the appropriate product department head for approval.

5 IBM Register. Each order would be returned to the order desk. Its invoice number would be entered in a register to show that it had cleared the preceding steps and was ready for the EDP room. The number of orders in this register would also be tallied with the number of invoices printed by the computer at the end of the day to check for missing or lost orders.

6 Preparation of the Invoice.

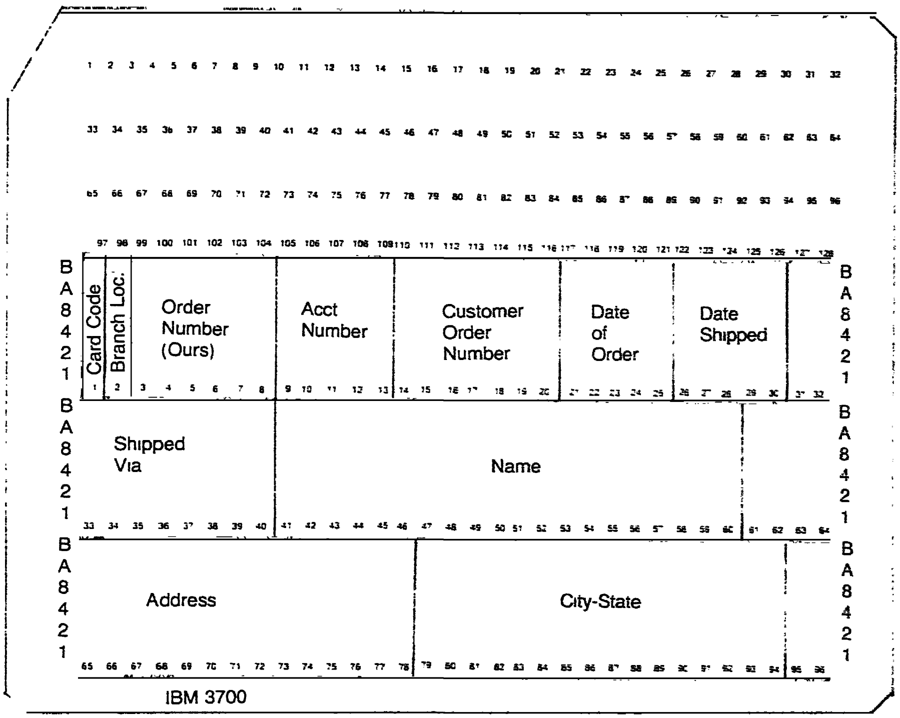
a The information on each order would be recorded on punched cards, using the IBM 5496 Data Recorder. One card (the header card) would be punched with general information about the order, while one or more cards (item cards) would contain information about the items ordered, as shown in Exhibit 6. The Data Recorder would also be used to verify the correctness of punching.

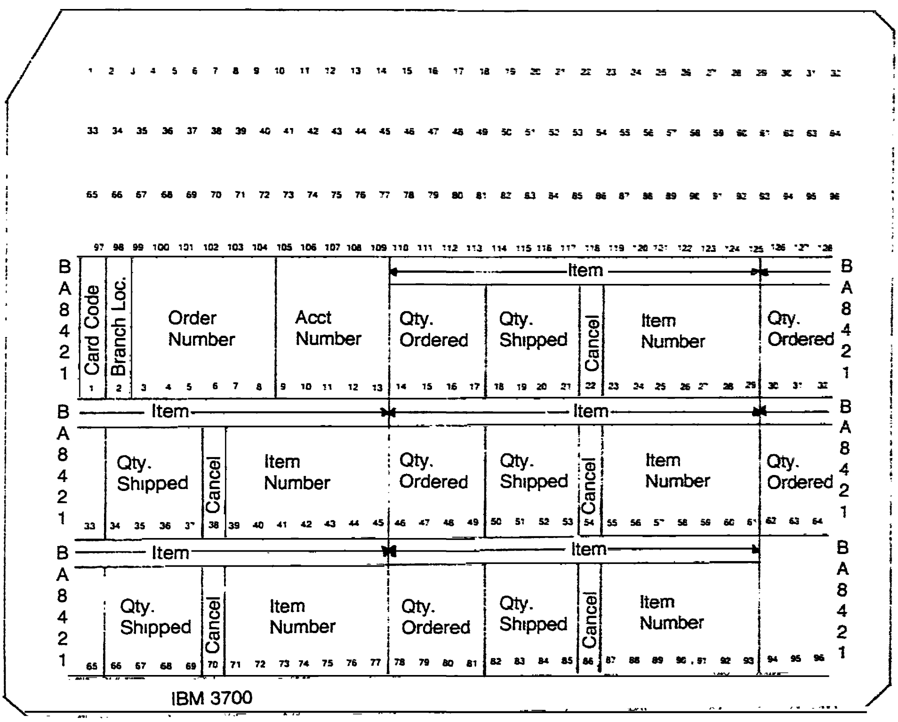
b At this point the System/3 could process the information because it would have both the Customer File (already described) and the Inventory File on disk. The Inventory File would contain such data as item code numbers, warehouse slot numbers and descriptions, information about the suppliers, stock on hand in the warehouse, and price. Exhibit 7 shows the arrangements of inventory records on disk. The exact sequence of the steps that would be performed by the System/3 is described in Exhibit 8.

c The output from the computer run would be printed invoice (original and three copies) and updated customer and inventory records.

7 The original of the invoice would be held in the EDP room until a check was made to determine whether all items actually were shipped. Then the invoice would be mailed to the customer. The three copies would go to the warehouse for use in the selection and packing of merchandise. All the items would be listed on the invoice in warehouse slot number sequence, so that merchandise could be selected continuously from the first item to the last and all back-tracking by the stockpicker would be eliminated. If any order could not be filled, two columns provided on the invoice entitled "Number Shipped" and "B/F (Brought Forward or Cancelled" would be filled in by the stockpicker, next to the items involved. After completion of this step, the copies of the invoice would be returned to the EDP room to be matched against the original order and customer copy. If changes were necessary, a new invoice would be prepared. One copy would then be attached

Exhibit 6 -- L. G. WYNANT COMPANY
Order Information on Header and Item Cards





Source: IBM System/3 Disk System Introduction, Form GC21-7510-0.

Exhibit 7

L. G. WYNANT COMPANY

Layout of Inventory Records on Disk

Type	Item No.	Description	Warehouse Slot No.	Vendor Codes			Lead Time (wks)
				= 1	= 2	= 3	

Date of Last Order	Cost of Last Purchase	% Inc.	Order Quantity	Price	Central Warehouse Inventory & Sales					
					On-hand	On-order	Re-order Point	Order Qty.	Sales This Per.	Qty. Cancel

On-hand	On Order	Re-order Point	Order Qty.	Sales This Per.	Qty. Cancel

Source: IBM System/3 Disk System Introduction, Form GC21-7510-0.

Exhibit 8
L. G. WYNANT COMPANY
Steps Performed by System/3

To print each invoice and update the customer and inventory records, the following processing steps are performed by the system under control of the program:

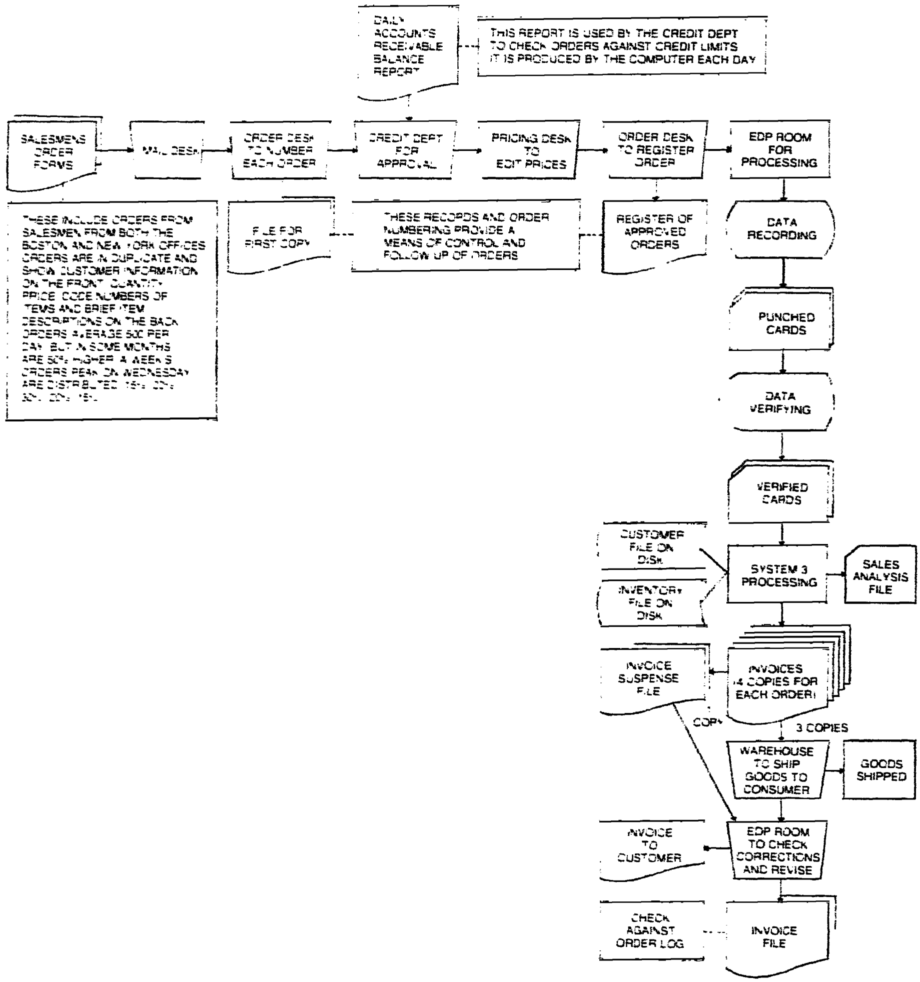
1. Read header card.
2. Get customer record from disk.
3. Print heading information on invoice.
4. Read item from item card.
5. Get item record from inventory file on disk.
6. Calculate item price.
7. Print item and price on invoice.
8. Update inventory record on disk.
9. Repeat steps 4 through 8 for each item on item cards.
10. Compute tax and total for all items.
11. Print tax and total on invoice.
12. Update accounts receivable and sales records on disk.

Source: IBM System/3 Disk System Introduction

Exhibit 9

L. G. WYNANT COMPANY

Flow Chart of Proposed System



to the original order and filed, while the other two copies would comprise the bill of lading set.

A flow chart of the proposed system is provided in Exhibit 9.

Reports under the New System

The proposed computerized handling of orders would automatically generate the following reports on a periodic basis.

- Accounts Receivable
- Stock Status
- Daily Sales
- Sales Analysis

The stock status reports would be printed bi-weekly for use by both the purchasing and manufacturing departments to determine when to order or produce a given item. Better inventory control could be expected to result in more efficient buying, which could lead to a reduction in inventories of as much as 30 per cent. Insurance and storage costs would also be lower with smaller inventories.

The periodic sales analysis reports would be designed to analyze the following.

- Sales and Profit by Customer
- Sales and Profit by Item for Each Salesman
- Sales and Profit by Item for Each Customer
- Sales and Profit by Item for Each Department
- Inventory Turnover

It was hoped that such analysis by product would lead to a reduction of up to 20 per cent in the number of items in the product line.

APPENDIX: System/3 Devices*

IBM 5410 PROCESSING UNIT

The IBM 5410 Processing Unit is the main storage and control device for the system. The storage section holds the program instructions for a job and data to be processed during a job. Although information is stored electronically, the idea is similar to a series of numbered mailboxes. Whatever is stored in one of the boxes, or storage positions, can be retrieved by knowing the box number or storage address.

The control section of the processing unit is the decision-maker and the calculator. It carries out the instructions in the storage section. For example, it tells the MFCU to read a card, the Disk Storage Drive to read a record, or the Printer to print a line. If the program calls for calculations--add, subtract, multiply, or divide --they are carried out in the control section.

The control section usually carries out program instructions in the order in which they are stored, beginning with the first instruction. However, instructions can be placed in the program to cause the control section to carry out a set of instructions located somewhere else in storage, then return to where it left off.

Input, output, and processing operations can be done at the same time. For example, while the processing unit is doing calculations for one record, the MFCU can be reading the next record and the printer can be printing the last record processed. This overlapping of functions helps get a job done faster.

The IBM 5410 Processing Unit is available in several capacities: 12,288 storage positions, 16,384 storage positions, 24,576 storage positions, and 32,768 storage positions. The larger the capacity of the processing unit, the more program instructions and data it can store. This can have a significant effect on how fast a job can be done.

*Source: IBM System/3 Disk System Introduction, Form GC21-7510-0.

IBM 5203 PRINTER

The IBM 5203 Printer provides system output in the form of printed reports. The arrangement of the printed information on the page is controlled by the program in the processing unit.

The printer uses a 48-character print set consisting of 10 numeric, 26 alphabetic, and 12 special characters. The print characters are assembled on a chain (see Figure 1).

The chain can be replaced with other chains containing different sets of characters. This permits the operator to choose a set of characters that best suits each job.

The printer can print in 96 positions across a page with a horizontal spacing of ten characters to the inch. Vertical spacing is six or eight lines to the inch as selected by the operator. Spacing between lines and skipping to a predetermined line on a page are controlled by instructions in the program.

The IBM 5203 Printer prints at a speed of 100 or 200 lines a minute, depending upon the model used. It can print an original and multiple carbon copies.

Universal Character Set Some jobs may require more than a 48-character print set. This optional feature offers character sets ranging from 49 to 120 characters.

Additional Print Positions This optional feature extends the 96-print positions to 120 or 132.

Dual-Feed Carriage This optional feature enables the printer to print two side-by-side forms at the same time. Each form is individually controlled by the program.

IBM 5424 MULTI-FUNCTION CARD UNIT

The IBM 5424 Multi-Function Card Unit (MFCU) is both an input and output device. It can read punched-card data into the system and punch output from the system into cards.

In addition to its reading and punching functions, the MFCU has other features that make it unique among card devices. It has two card hoppers, a read station, a punch station, and four stackers (see Figure 2). Cards can be fed from either hopper and selected into any stacker according to instructions in the program.

Figure 1
Print Chain

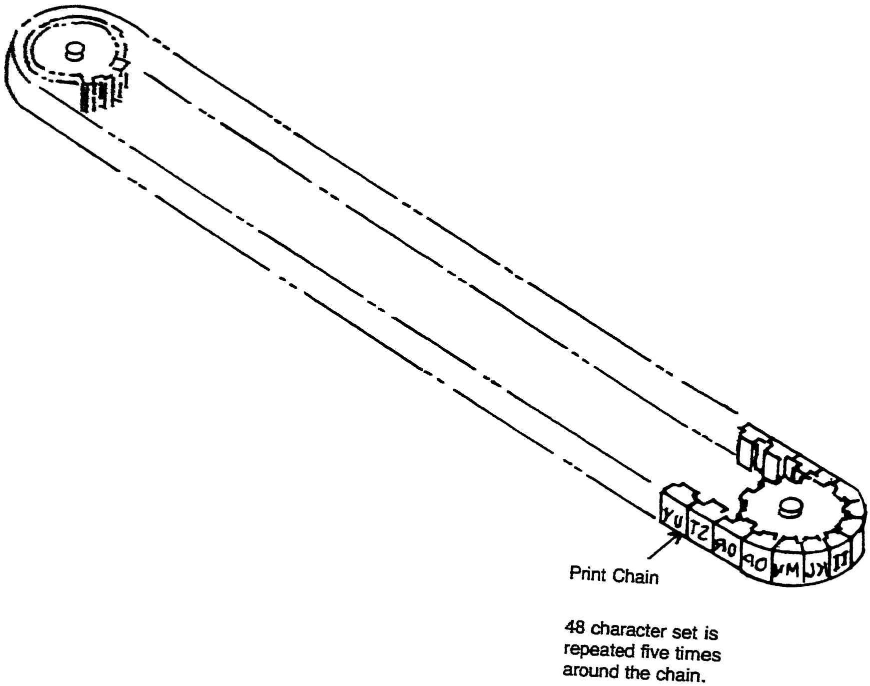
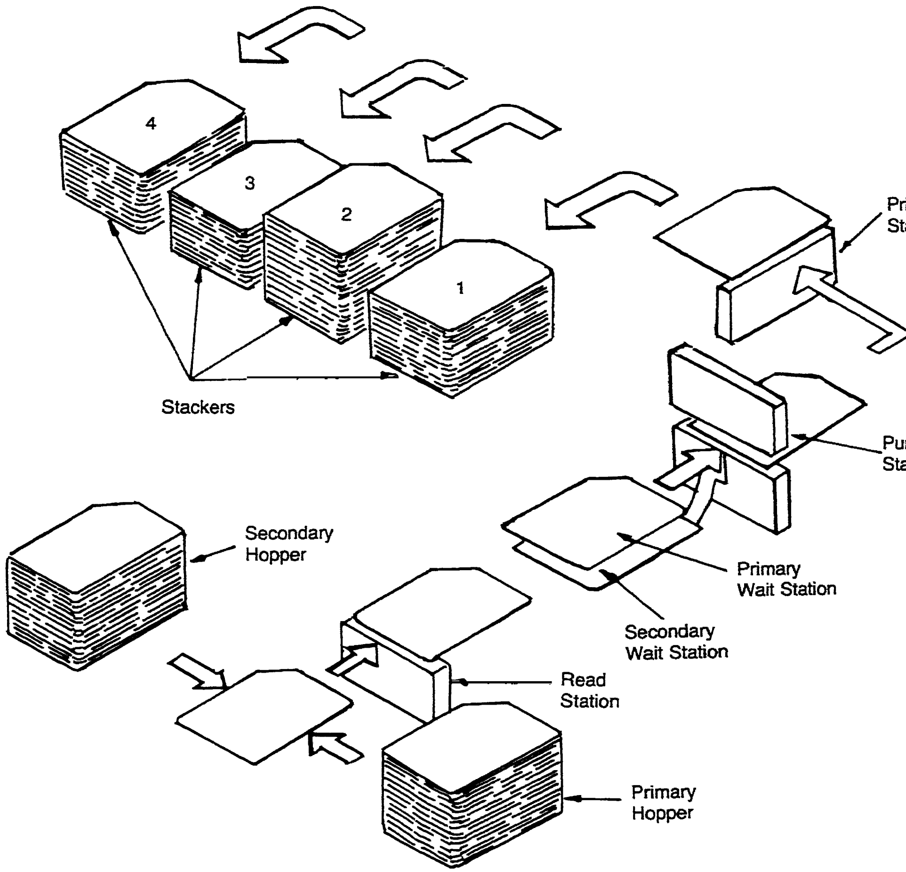


Figure 2
MFCU Card Path



Two separate files can be processed. One can be used as input and the other can be used as output, as in reproducing cards; or both files can be used as input. Data from each file can be combined as necessary during processing.

The MFCU can match records within two files, merge two files, and select records. Sorting can also be done.

Card Reading

The MFCU reads each card serially (three columns at a time, one from each tier). Maximum reading rate is 250 cards a minute or 500 cards a minute, depending upon the MFCU model used.

Reading is accomplished by 18 solar cells. As the card moves through the read station, light passes through the punched holes and is converted into electrical signals by the solar cells.

Card Punching

The MFCU punches cards serially (three columns at a time, one from each tier). Card punching is done at a maximum rate of 60 cards a minute or 120 cards a minute, depending upon the MFCU model used. As a card moves through the punch station, the stored program activates appropriate punch magnets, causing data to be punched.

Card Printing

At the print station, data can be printed at the top of the card. Up to four lines can be printed, under program control. Each line has 32 print positions.

Maximum printing rate, for up to three rows of printing (top three rows), is 60 cards a minute or 120 cards a minute, depending upon the MFCU model used. The fourth row of printing is also done under program control, but with a reduction in printing speed.

MFCU Control Panel

A control panel at the right of the primary hopper provides the lights and switches necessary for operator control of start, stop, and card runout.

IBM 5444 DISK STORAGE DRIVE

The IBM 5444 Disk Storage Drive is in a drawer under the MFCU. The basic unit consists of one drive, two disks, and an access mechanism (see Figure 3).

The lower disk is mounted permanently on the drive. The upper disk is removable and can be replaced with other disks. To protect the disk surfaces from damage, the upper disk is completely enclosed in a cartridge. This also makes it easy to handle and store.

The access mechanism on the disk drive has four read/write heads, one for each surface of the two disks. When activated, the access mechanism moves the heads back and forth across the surfaces of the disks to any designated position. The heads move together. When one is positioned at a certain place on one disk surface, the others are positioned at the same relative positions on the other three disk surfaces.

Depending upon the model, the IBM 5444 can record data on 100 or 200 cylinders on each disk. (Corresponding tracks from each side of the same disk are called cylinders.)

Tracks are divided into 24 equal parts called <u>sectors</u>. Each sector of a track has its own unique address. Two hundred fifty-six characters of data can be stored in each sector (see Figure 4).

Disk storage is available in four different configurations:

- Configuration 1: Contains one drive and two disks. Uses 100 cylinders on each disk. Total storage capacity is 2,457,600 characters.
- Configuration 2: Contains one drive and two disks. Uses 200 cylinders on each disk. Total storage capacity is 4,915,200 characters.
- Configuration 3: Contains two drives and three disks. Uses 200 cylinders on each disk to drive 1; on drive 2, uses 200 cylinders on removable disk only. Total storage capacity is 7,372,800 characters.
- Configuration 4: Contains two drives and four disks. Uses 200 cylinders on both disks on both drives. Total storage capacity is 9,830,400 characters.

Figure 3
Disk Storage Drive

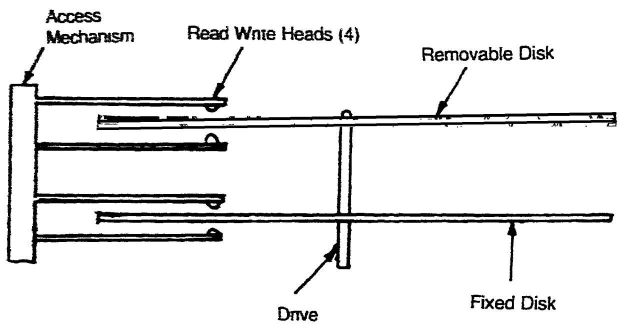
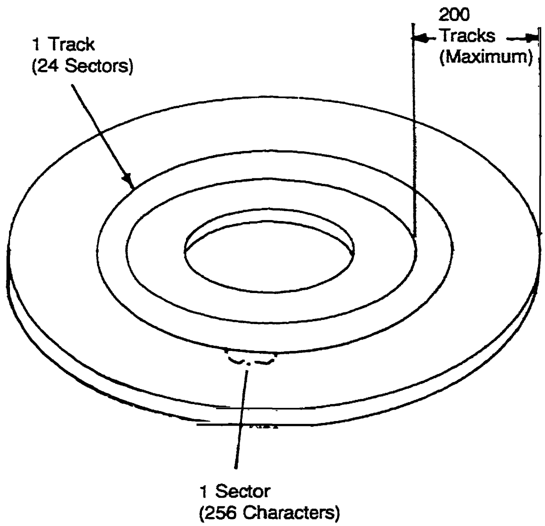


Figure 4
Tracks and Sectors on a Disk



IBM 5471 PRINTER-KEYBOARD

The IBM 5471 Printer-Keyboard can be installed on the system. It consists of an IBM Selectric® Typewriter connected to the system processing unit. With the printer-keyboard, the operator can:

1 Request information from a disk file on the Disk Storage Drive.
2 Print out requested information.
3 Enter data directly into the system.
4 Use the printer-keyboard as a second printer for low-volume output.

The 5471 Printer-Keyboard has a 44-character print element. It can print lines up to 125 characters long at an approximate rate of 15 characters a second. Multiple copies can be printed.

IBM 5496 DATA RECORDER

The IBM 5496 Data Recorder provides operator-controlled card punching, printing, and verifying. The data recorder has a 64-character keyboard, a card hopper, a punch station, a read station, a print station, and a stacker. Reading, punching, and printing rates are 60 columns per second.

The data recorder features a buffered input-output area; that is, data is collected in a key-entry storage area and is not punched until all data for a card has been keyed. This allows the operator to erase and rekey any data he wishes. One character, one field, or a whole card record can be erased and rekeyed.

Overlapping of punching and keying functions increases the rate at which data can be recorded. While one card is being punched, data for the next card can be keyed.

Prepunched program cards can be read into storage at the start of a job to control automatic functions, such as skipping or duplicating, on a card-field basis. Up to four program cards can be stored. The operator can select any of the four program levels while punching.

Hollister Manufacturing

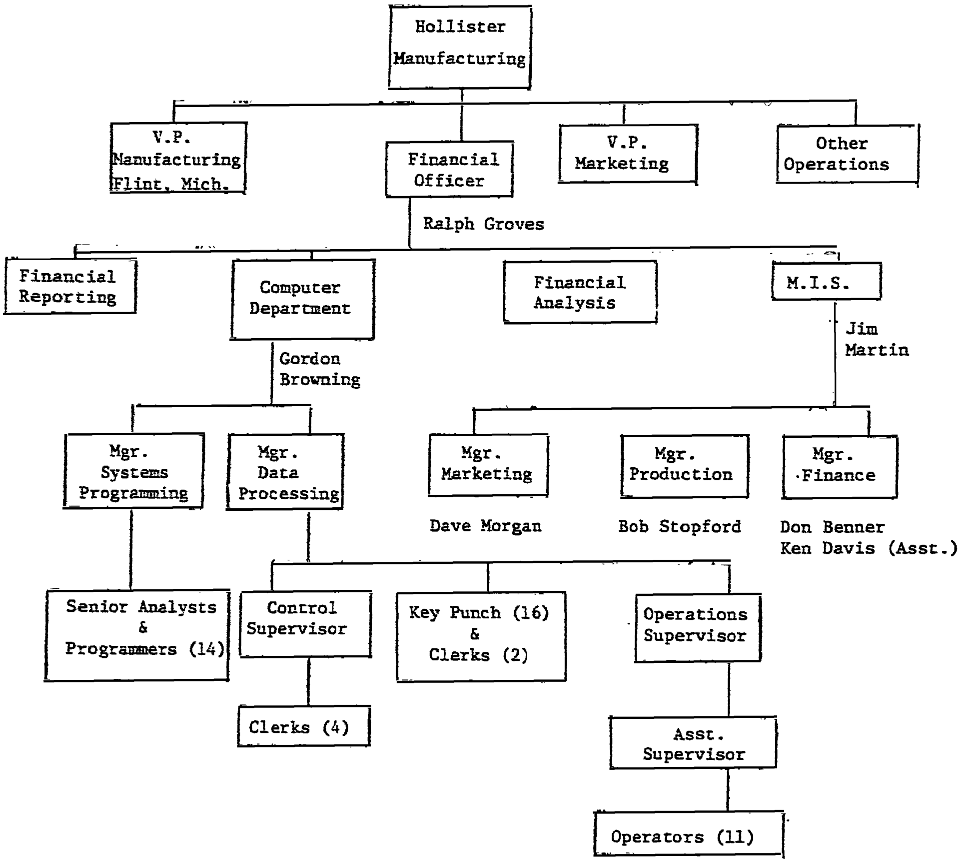
Late in August of 1979 Jim Martin, manager of Management Information Systems of Hollister Manufacturing, was wondering how well the proposed pilot study on data collection would be received by line operating managers. If successful, this pilot study would be a major contribution toward Hollister's eventual goal of a fully integrated information system. For Jim it would mean that his first few months at Hollister had been well spent. A successful pilot project would be an indication that Hollister's Management Information System really could get "on the air." This Jim realized would be a major accomplishment because the original information system was to be successfully running in early 1978; however, as of August 1979, there was a long way to go before full implementation would be accomplished.

Company Background

Hollister Manufacturing (see Organization Chart--Exhibit 1) manufactures and sells power and hand tools for both commercial and home use. These tools range in complexity from simple hand tools such as hammers, saws and screw drivers to very complex power tools such as a complete home shop. In addition Hollister operates a product service department that repairs or modifies tools and sells replacement parts. Hollister International also manufactures and sells power tools in a number of overseas countries from Japan to Canada. Founded over a hundred years ago in Flint, Michigan, Hollister originally produced only hand tools. After 1931 Hollister began to expand the product line. Growth has been particularly rapid since World War II, and today Hollister has sales of approximately $125,000,000 per annum.

Although Hollister has all of the above businesses adding to the complexity of daily operations, this case deals primarily with the operations of the power and hand

Exhibit 1
HOLLISTER MANUFACTURING
Organization Chart



tool plant in Flint, Michigan. The Flint plant produces and sells almost a million tools a year. This accounts for one third of Hollister's total yearly sales. Some 1500 different components make up the 300 various tools produced. Of these 1500 components, 20% are purchased for direct assembly while the remaining components are manufactured from raw materials at Flint.

The process of producing a tool is a mixture of a batch or job-shop-type process and a production-flow process. Parts are produced in seven manufacturing areas. These areas are: electric motors, air motors, case machining, gear shop, metal coating, wood and small metal parts. There are approximately twenty operations on each part as it is converted from raw material or wood stock into a finished component. These components are sent to finished goods stores and then to three assembly shops. There the final assembly of the tools takes place. As there are on the average 50 parts to a power tool, there are great scheduling difficulties involved in assuring that the right number of parts are ready for assembly at the same time. This is particularly acute because these parts have different production cycles ranging from a few days to a few months, as well as different optimal batch sizes for production. A power tool can't be assembled until all parts are at finished goods stores; thus the delay of even one part either from purchasing, engineering, or production can throw the whole plant off schedule. This usually causes expediting in the form of interrupting optimal lot sizes to push the delayed item through. Each part expedited can lead to further production interruptions. The skills required of some two thousand employees working on power tools vary from highly trained setup men to low-skilled personnel whose function is to load or unload parts from a machine.

Today's power tools plant in Flint is a study in contrasts. The plant still utilizes some quite ancient machinery that was built at the turn of the century. For example, wood handles for a few custom hand tools are still turned out on equipment utilizing power from an overhead belt. In a separate section of this plant that dates to the 1900's is the air-conditioned computer and data processing center that houses an IBM 370/138 computer. The firm has placed an order for a new 4341 in anticipation of the need for more on-line processing.

HISTORY

History of Data Processing

Tab equipment had been used at Hollister since 1948. The company progressed in this mode through IBM equipment (602 to 604 to 650). In 1958 payroll, sales analysis, general ledger, accounts payable systems were placed on the 650. In 1962 an IBM 1401 replaced some of the previous tab equipment.

Gradually, batch applications in accounting and order processing were added as equipment was upgraded to an IBM 360/30, a 370 model 135 and finally to the current 138.

In 1973 Hollister's management hired a consultant to advise the company in the data processing area. This consultant told the company that the computer was inadequate in terms of capacity and that it was being poorly utilized by the present computer personnel as well.

Design of Integrated Manufacturing Control System

The Hollister management not only accepted the consultant's advice, but retained him to design a manufacturing information system.

During 1974 the consultant designed an integrated manufacturing information system to handle the requisite information flow throughout the plant. As seen by top management, the objectives of this manufacturing information system were to be as follows: 1) improve control over work-in-process inventory; 2) improve scheduling and expediting by more timely and accurate information; 3) obtain accurate and up-to-date information on the location of parts throughout the plant, which was to lead to work-in-process inventory reduction.

A description of the information system for the power tools' operations follows. First, a marketing forecast was manually developed in terms of numbers of tools for a given year. This forecast was then exploded into production and purchase parts requirements. From these requirements, engineering changes and present inventory status were merged to provide production with a current file of production needs, from which production control could schedule the machines on the shop floor. Production control was to use job cards (I.D. for each operation) and travelers (list of all the required operations necessary

to complete and send an item to finished parts stores) to control the production process. After each operation, the job cards would be fed into data collection terminals located on the plant floor. The remote terminals would relay the information to a central computer. Thus, both the production and finance groups would gain improved control over production and cost data. In theory, all of these activities were to take place on the computer.

Implementation

This system, called Manufacturing Control System (MCS) was implemented in January of 1975. The system utilized the IBM 370 computer coupled to a small number of terminals. Although the system was in theory well conceived as a computer-based system and appeared to have the necessary elements in design to make it operational, the MCS was subject to many complaints and was greatly reduced in scope by April of 1975. Present management (there has been a substantial turnover in EDP personnel and higher management since 1974) describe some of the failings as follows:

1 Implementation--"too much, too fast"--The entire system was tried at once (at a daily volume of some 2000 job operations). One line manager stated that the whole plant was in virtual chaos.
2 In the one manufacturing area that data collection was attempted, data from all 100 parts in the shop was fed into the 7 terminals comprising the system. With an average of 30 operations per part in this area, there was a significant amount of data collection activity. Workers (approximately 150 in this manufacturing area) were scrambling about attempting to get their information into the collection terminals. This was particularly chaotic during change of shifts when all the workers in the shop converged on the terminal at once. These workers who are paid on piece rate complained bitterly that they had to slow production without pay just to get their data entered.
3 Timing poor--
   a The head of production control stated that demand for power tools had been increasing at greater than 30% per annum resulting in acute scheduling problems for production control as available capacity became more and more strained. The plant was operating

three shifts per day and still falling behind production schedules.

b The company was going through a complete model changeover at the time. A model changeover for a power tool is not too dissimilar from an automobile model change. New tools and dies are required which necessitate new standards for production control in terms of setup hours, worker output per hour, and machine utilization.

c Technology was undergoing rapid changes in design and manufacture of many of the parts. The engineering group was modifying tools and the method of production (process change) of the tools. For example, the wood shop manager mentioned that a handle would be completed in his shop at the same time that a drill brace design or process change would occur, causing the two pieces to no longer fit together. The handles or the drill braces would have to be changed or one of the two parts scrapped. In many cases the costs saved as a result of the engineering change would be all but dissipated by the time and costs incurred in rework or reproduction. The result of this environmental situation was that the operations management did not or could not devote time to understanding the information system.

Education of users (both managers and workers) who were to use the data collection system was neglected. Managers weren't able to assist the workers in the data collection process. On the other hand the workers soon realized that the new system would prohibit overreporting for pay purposes, something that a few workers had been getting away with previously. Thus, there was little incentive to complete the input correctly. The system was programmed to record 50 different kinds of events. Next to the data collection units was a two-inch manual with instructions describing how the worker was to enter data on the terminal. (A portion of these workers can neither read nor write). Disorder and confusion followed. Data was entered incorrectly; the error rate was in excess of 30%. Job operation numbers were mixed with manufacturing area numbers, lot sizes, employee numbers, dates, times, and so forth. In addition, control between areas was virtually impossible to maintain because each manufacturing area had its own peculiar method of reporting.

5 Psychologically, some foremen felt threatened by the "mystique" of the computer. A few of these managers would not cooperate in the implementation of the computer. In the past these foremen had received budget allocations based on reported output. Because reported output would now be less because of more accurate reporting, their budgets could suffer.

6 Programming and Design didn't meet specifications. The program did what it was supposed to do; however, line managers thought that the program was to accomplish something different than what the consultant actually designed. For example, managers thought that the worker had to enter only the quantity completed, while the designer planned to have the worker enter the lot number and other items previously mentioned. In addition, it was found that some parts had different control numbers, and some different parts the same control numbers, depending on which area they were in at the moment. For example, a band-saw blade would have one number in the small metal parts shop, and a different number in assembly. The computer showed different items being produced and thus an incorrect number of items for production control. It was felt that the primary reason these problems occurred was that management had given total reliance on the consultant to design the system, and operational users were not considered a necessary part of the design effort. As a result, these necessary user considerations were never designed into the system. The net result was that managers predicted the system wouldn't work, and it didn't. Therefore, a few months after initiation, the system was withdrawn and in mid-1975 Hollister slowed its implementation effort.

1973-1975 in Retrospect

In its reviewing of the disastrous attempt at an integrated information system, two areas of mistakes seemed most apparent to management.

1 Consultant--The role of the consultant who originally designed the system was too dominant. The management accepted his word as gospel and never really limited or defined his position. Some managers who attended the system design meetings sat in virtual awe of the consultant. A few managers would bring tape recorders to the meetings

to assure themselves of having each word of the description. Many managers didn't understand the system well enough to ask questions, so most of the meetings were spent with the line personnel nodding their heads in blind acceptance of what was being proposed. As a result, the company had a system designed by a person not familiar with Hollister's operations. The system design consequently overlooked many details of the realities of life within the company. In summary, the consultant first designed the system and then explained its parts to various managers.

2 Management--From the beginning of the design of the system, managers were too busy with day-to-day operations to concern themselves with the information system. Managers at all levels failed to understand how the system functioned in its entirety. No rapport was ever attained between the users and the EDP group. In short, communication among users and designers was never achieved until the implementation phase and subsequent problems forced these people together.

PRESENT

The System Today

Some four years later in July 1979 the system is slowly progressing to a state of a fully integrated information system. Gordon Browning, manager of the Computer Department, mentioned there are 36 man-years of programming and design which have been expended in the system's development. The major work of the past 18 months has been spent on reorganization, redesign, and addition of an 370/138 computer. A brief description of the present system follows:

a Manufacturing Control System (numbers 13-27*)
b Payroll (numbers 14, 25)
c Order Processing and Billing (numbers 2, 3, 4, 8, 9, 11)
d Accounts Payable (number 28)
e General Ledger (numbers 27-31)
f Marketing Reports--Sales Analysis (number 6) by
- Product
- Customer

*Note: Item numbers refer to programs and reports of Exhibits 2 and 3.

- Territory

g Accounts Receivable (numbers 6, 9)

h Product Service
  - Inventory (numbers 6, 7, 8)
  - Billing (numbers 6, 8, 9, 11)

i Power and Hand Tools Demand Forecast--(number 10)

The information system as it now is designed is shown in Exhibit 2. Whereas before marketing and finance sections were based on separate data files and were independent of MCS, now all three areas are interdependent by use of the same data base. Exhibit 3 is a general description of the system. So that the reader can more fully comprehend the complexities of the integrated information system, the middle portion of Exhibit 2 is presented in much greater detail in Exhibit 4. This part deals with the Manufacturing Control System (MCS) which originally had so many difficulties during the implementation phase in early 1975.

Organization

In 1979 the present organization for information processing is under the responsibility of the financial officer, Ralph Groves (see Exhibit 1). Two men who report directly to him are Jim Martin, manager of Management Information System (MIS) and Gordon Browning, head of the Computer Department (CD).

Jim Martin, who joined Hollister in June of 1976, has a consulting background in the area of long-range planning, information system design, and computer equipment selection. Jim heads three MIS managers, each heading a functional area, e.g., marketing, who tie in with the users at the design phase of programming. Each MIS manager has two basic responsibilities. First, each must accomplish an administrative mission, that of being the project leader for the particular area requiring information systems development. As an administrator, the MIS manager must assume effective communication in the CD and user process, in particular, to educate the users toward understanding the information system. Second, he must carry out a technical role, one of insuring that the actual programs are successfully developed. This includes developing specifications for the coding, decision rules, and manual procedures required to successfully implement a program.

(text resumes p. 117)

Exhibit 2
HOLLISTER MANUFACTURING
Overall Information Flow

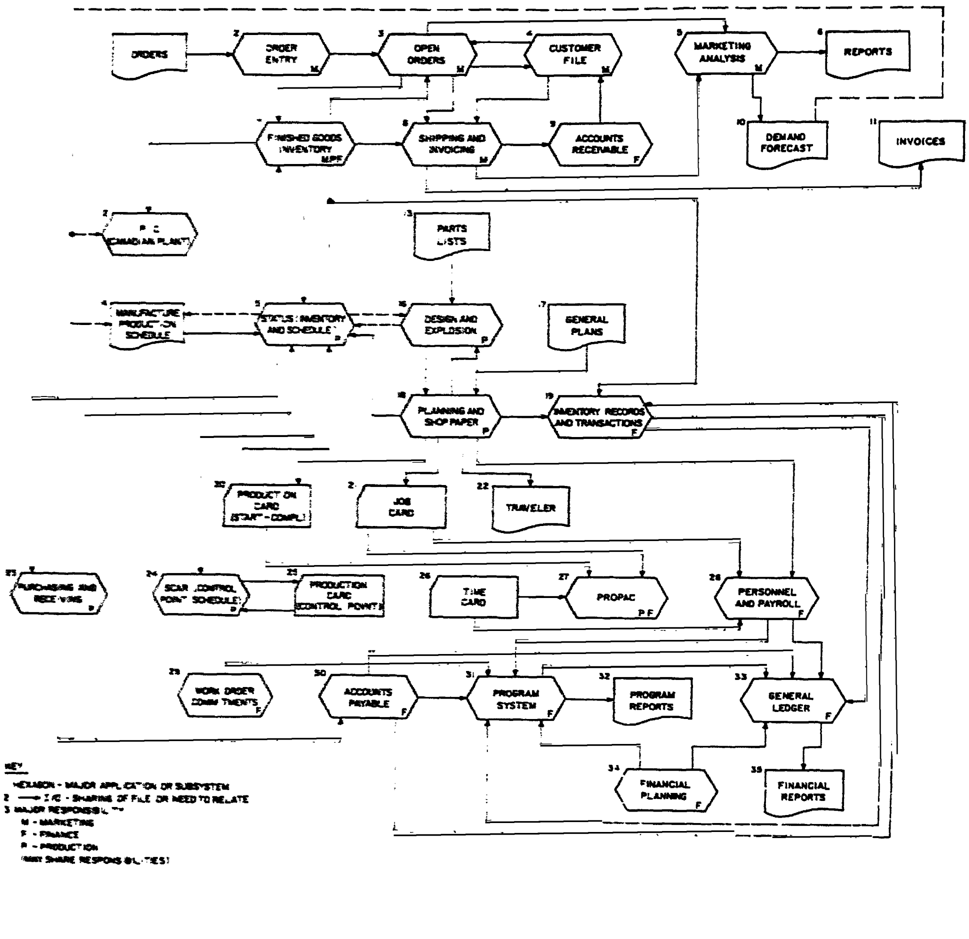


Exhibit 3
HOLLISTER MANUFACTURING
Over-All Information Flow

This exhibit explains the flowchart of Exhibit 2. The numbers refer to major programs of Exhibit 2. The first program in the information processing system is the Order Entry Program (#2). This program processes orders as they are received at Hollister. Its function is to audit the orders received. The audit is a validity test to prove the customer number, item number and the reasonableness of the order entry, e.g., an order for 10,000 hammers would be valid, whereas an order for 10,000 complete home shops would not.

Immediately following this step, the Open Orders Program (#3) processes the order entries as additions to the file of orders received but not yet filled, and the shipments from finished goods inventory as deletions to the open order file. The net result of this program is to maintain a cumulative up-to-date listing of orders not yet filled. The Open Orders Program relies heavily on the data from the Customer File Program (#4) which maintains a customer file of shipping addresses, shipping priorities, and billing addresses if different from the shipping addresses. The Customer File is similarly used by both the Shipping and Invoicing Program and Accounts Receivable Program.

The Marketing Analysis Program (#5) receives inputs from both the Open Orders and Shipping and Invoicing Programs. With the sales and order data inputs, this program produces the demand forecast and various marketing reports. The Demand Forecast is for both P.I.C. (#12) (the Production Control System for the Canadian plant), and for the Master Production Schedule (part of M.C.S.) at Flint. Every other month the marketing analysis group updates the yearly demand forecast. The demand forecast is the requirements from the forecast data one year into the future. A considerable amount of high-level management control enters the system at this point; thus the use of a dotted line in Exhibit 2. This section is a key to the system, for a poor forecast would be very costly. For example, should marketing forecast poorly, optimum production quantities would be off by this amount. During the nine-month production cycle that followed for some of

the larger items, Hollister would be either stuck with too many tools or be continually having to expedite and increase production to fulfill demand requirements. In both cases inefficiencies on the production floor will occur. The Master Production Schedule is in numbers of tools by symbol (type of tool, e.g., air hammer). The other marketing reports produced by this program include a variety of sales analysis such as sales by product, area, salesman, customer, on a cumulative-month-and-year-to-date basis.

The Finished Goods Inventory Program (#7) updates the status of finished goods and affects all areas of the system. Primarily it updates the perpetual record of inventory available. It also anticipates the next few days' output for forward planning, and breaks down orders into future delivery and past due delivery dates.

The Shipping and Invoicing Program (#8) receives data from the Finished Goods Inventory and Open Orders Programs. It produces shipping documents (where and when to ship) and customer invoices.

The Accounts Receivable Program (#9) updates the Accounts Receivable File and receives as inputs new billing and payment data. This program uses the customer file heavily for billing purposes.

The Status (Inventory and Schedule Program) (#15) considers the data from the master production schedule as known today for the next 12 months and adjusts for lead times on raw materials and the production cycle of the particular part being produced. Because of long lead times in raw materials of metal and wood (wood also must be properly dried), a production cycle for some tools is nine months; thus, the need for accurate forecasting. The status program produces the schedule and accomplishment report (SCAR). SCAR is used for control purposes and is a weekly record of production of each component at various control points throughout the plant. Presently control points are spaced every five operations or so to maintain control of the work process. SCAR lists all control point completion dates so as to keep a running account of the work in process, and is primarily used by production control as an "ahead/behind" schedule document.

Exhibit 3 (Continued)

The Design and Explosion Program (#16) produces a master file of current design of the products and the requisite parts. The output is a current design list of parts. This list contains the code number of all parts in the plants as presently designed.

The Shop Planning Program (#18) keeps track of the way parts are produced. Each week there are approximately 30 process changes. The Shop Planning Program uses planning documents and the planning file as an input. The planning file is a detailed description of bill of labor that describes the requisite operations to produce a part. The outputs produced by the Shop Planning Program are: a production start and/or complete card, a job card and the traveler. The production start and/or complete card is used to update the inventory status and also for information to PROPAC. PROPAC (#26) is a control program that flags instances where the number of parts reported as completed through a prior operation. The Job Card is a card for each operation on a part (see Exhibit 6). Traveler is an I.D. for a batch of material that has several operations to be performed on it. This traveler is a running score card of operations performed and remaining to be performed on a particular batch (see Exhibit 5).

<u>Note:</u> The above operations 7, 15, 16, 18, 23, 24 of Exhibit 2 provide the real "guts" of the manufacturing control system. Exhibit 4 shows these activities in greater detail.

The Inventory Records and Transaction Program (#19) accepts data from the Finished Goods Inventory Program, adds the cost data and provides inputs to the General Ledger Program.

The Purchase and Receiving Program (#23) updates and is updated by the inventory status file. This includes all goods or materials that are purchased from outside of the company. This program generates inputs for the Accounts Payable Program (#29). The Accounts Payable Program merely keeps track of all payables of Hollister, adding new payables as they are received from Purchasing and Receiving, and deducting accounts paid.

Exhibit 3 (Continued)

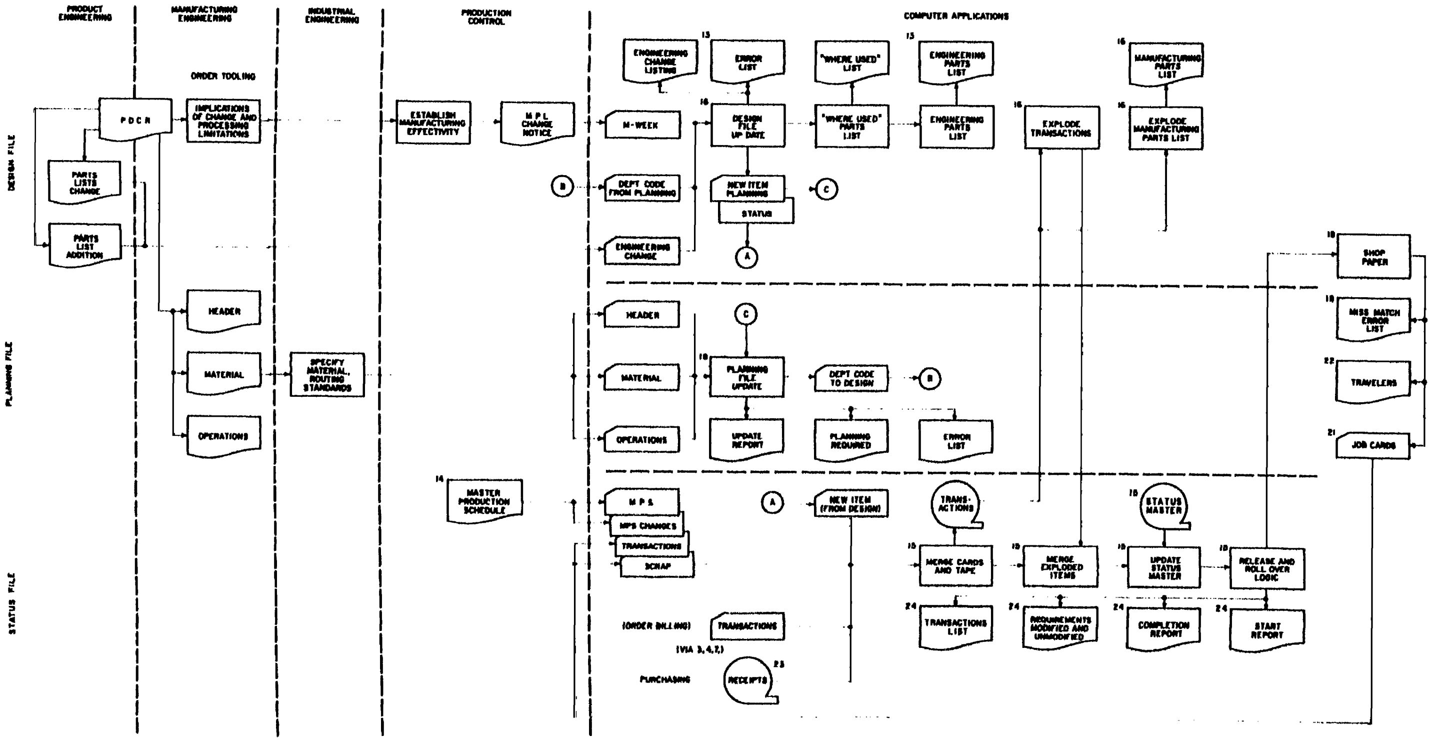
The Personnel and Payroll Program (#27) receives inputs from the production floor in terms of job cards and employee time cards. This program is input for the General Ledger Program.

The General Ledger Program after receiving inputs from Inventory Records & Transactions, Personnel and Payroll and Accounts Payable produces a variety of financial reports. These include trial balances, income statements, expense performance reports, and balance sheets.

Exhibit 4

HOLLISTER MANUFACTURING

MCS through Start and Completion Logic



Note to Exhibit 4
HOLLISTER MANUFACTURING

The three major files pertaining to Exhibit 4 are design, planning, and status.

Design file--

1. Parts list
2. Product drawing number
3. Way in which parts relate to each other, e.g., a bearing is a subpart of a shaft, which is a subpart of a casing assembly
4. Timing of parts change, e.g., when a newly modified part is to replace an old part as the standard component for the parts list

Planning file--

1. How to make a part (manufacturing process)
2. Source of responsibility
    a) If a buy item, then purchasing
    b) If a make item
        (1) then which department has primary responsibility for producing the part
        (2) sequence of operations
        (3) materials to use
        (4) manufacturing standards from Industrial Engineering
        (5) lead times
        (6) required machines for making the part

Status file--

1. Perpetual inventory record of each part or subassembly by component number
2. Complete production schedule (start times for the first operation of a part's production process and completion of the last operation in the process)

The numbers identifying various parts of Exhibit 4 match the location of these parts to those shown on Exhibit 2. The basic cycle for an updating of the three files is one week.

Inputs

MCS begins with a design or process change approval by Product Engineering in the form of a product drawing change request (PDCR). This request is forwarded to

Product Engineering which draws up a Parts List Addition. These, specifying additional parts to be added to the tool, serve as the originating documents for the updating of the design files. Manufacturing Engineering also takes the PDCR and uses it to draw up a Header (cover sheet for the new part specifying the item number, engineering drawing number, and description), Material, and Operations specifications (list of the required materials and operations necessary to complete the production of a part). Industrial Engineering then uses this data to determine production methods, and sequence of operations. Production Control determines the manufacturing effectivity which is the date when the newly designed part is to become the standard item for the tools and draws up a manufacturing parts list change notice.

Once a week Production Control forwards the master production schedule and manufacturing parts list change notices to the Computer Department (CD) to enter in the normal weekly updating process.

CD

CD first converts all MPL Change Notices (Parts List Changes and Parts List Additions) into punched cards. CD punches the manufacturing effectivity date on to a card which is called M-WEEK. This process also requires a card called the department code card. This card, from the planning file states which department is to manufacture the part.

The design update program produces the following outputs:

1. An Engineering Change Listing that lists all new additions to the parts list.
2. An Error Listing which identifies items to be corrected and reentered into the system.
3. Input for the "where used" program which produces,
   (a) a "where used" parts list that lists each part and its next higher assembly component (e.g., a winding goes into an electric motor),
   (b) input for the engineering parts list program that produces a current engineering list of all parts by item number and description

4. A new item planning card and a status card which are used as inputs to the planning file and status file updating processes respectively.

CD converts the information on the Headers, Material, and Operations Specifications into punched cards. The planning file is then updated by these cards summarizing the data on the Header, Material, Operations Specifications, and new Item Planning. It produces the following outputs:

1. An update report that is a current listing of the manufacturing operations and materials required to produce each item. This report specifies the departmental responsibility for each part, either for a manufacturing department or for purchasing. This report also specifies the manufacturing standards, machines needed to produce the part, and the manufacturing lead times.
2. Planning Required Report that notifies Industrial Engineering that there is a part in the design file that requires some additional planning. Industrial Engineering will then reenter their additional planning in a similar manner to the originial Header, Material, and Operations Specifications.
3. Error List for reprocessing and reentry.
4. A department code card stating which department is responsible for the part. This card is used to update the design file.

The status file is updated by the previous master production schedule (MPS), all MPS changes, and by the previous week's transactions (starts, completions, shipments) and reported scrap. At this time, a card from the design file (process and design changes) with new item information is added to the file. The week's transactions in terms of new orders is added from the order-billing file. Finally, data concerning all purchase receipts is added. All of these cards and the tape are merged to form a transactions tape. This transactions tape is "exploded" into manufacturing parts requirements using the design file. It should be noted that items coming from some transactions and scrap are in the form of subassembly or finished tools (e.g., delivery of a subassembly to a store room). Therefore, these items must be exploded by the

design file into individual parts requirements. The detailed parts transactions produced by the design file is remerged with the transaction tape to obtain a complete sequencing of the data. This sequenced data and the status master tape (complete unit record of inventory) are updated in the status master update program.

The updated status master goes through a release and rollover program (this program views the schedule from current data to one year in future) which produces a transactions list, modified and unmodified schedules, completions, and start reports. The transaction list is a complete listing by part number of all the activity for the week. This activity includes the number started into work in process, the number completed and sent to finished parts stores, and the number of actual shipments from the plant. The unmodified schedule is a calculation of the gross yearly requirements for each part by week needed. The modified schedule shifts back in time to allow for a buffer stock of some two weeks' supply.

In addition it attempts to schedule a reasonable economic order quantity (EOQ) for production. The completion report shows which week each part is supposed to be in finished parts stores to await assembly. This report also shows the amount in finished parts stores. The amount in finished parts stores will be shown as a surplus if parts are completed before their required date. The start report views the modified schedule and includes the production lead time for each part to determine the date each part is to be started into work-in-process inventory. This report will show numbers as negative or positive depending on whether the amount in W.I.P is in excess or below the authorized start quantity. In brief, the completion and start reports provide production control with the weekly status of each part in terms of whether the plan is completing each part according to schedule or starting the authorized quantity of the part into production.

This updated status master is sent back up to the planning file to produce various paper work called shop paper. The shop paper includes an error list (for correction and

reprocessing). the travelers, and job cards (see Exhibits 5 and 6).

The entire process is accomplished once each week and serves to keep track of the production process from new items design and planning through production scheduling.

Jim's main problems are to communicate successfully with management on the one side in defining needs, and with the systems analysts in designing the information system on the other. Although very new in the Hollister management, Jim realizes "there is a long way to go before the integrated system is fully integrated." Much programming and redesign still is required to complete the information system, and more work is needed in the communications area.

Gordon Browning, who has an extensive data processing background that includes design of computer languages and equipment as well as systems and programming work, joined Hollister in July 1973. Since arriving, Gordon has worked to establish rapport with the users. In 1973 there was a definite lack of communication between analysts and user types. For example, marketing users would want billings in a particular way one month, then change format a month later. Of course, in an integrated system, it is not a simple task to change a computer program because of the interface with other inputs and outputs. A second example would be marketing's use of tool sysmbols. When making a change, marketing would change a particular symbol from T1201 to T12001 which, although satisfactory for their purposes, would no longer fit the input format of various programs utilizing the tool symbol.

Gordon had to devote efforts to organizing and controlling his own section (Exhibit 1) which now numbers some 53 people. Adding to his difficulties was a 30% annual turnover of data processing and systems personnel. Gordon feels that the concept of fully integrating information has come a long way since the initial downfall in 1975, but that there still is a long way to go. At least now managers on all levels are interested and support the information system, although communications are still not perfect.

The Information Process

Jim Martin explained the development of an information program and the user-MIS-CD interface as follows. The MIS manager must first familiarize himself with the activities of his functional area. For example, Bob Stopford, the manager for manufacturing information systems, spends much of his time with operations personnel. After becoming thoroughly knowledgeable with the user requirements, Bob defines the area of production needing information

systems development. With the help of a senior systems analyst from the CD group, he will define the job in sufficient detail to turn the job over to a junior systems analyst and then to the programmers. The normal process would include Bob, the senior system analyst, one or two junior analysts and one or two programmers. Together with several user representatives this group forms a project team. There are many meetings and discussions between users, MIS, and CD, with Bob allocating 40% or his time with users, and the remainder almost evenly distributed between working alone and working with the systems analysts. In so doing he is able to educate the users during the design of the system, assuring that the details are hammered out and understood.

Future Outlook--Data Collection

Effort is being expended to reintroduce a data collection system to the production floor. So much of the financial and production control data requires accurate information from the floor that a truly integrated system cannot function correctly without this data. Presently much of the data being manually collected is so inaccurate in terms of parts produced (over-stated on job cards) that production delays occur. In addition, union workers, paid on a piece-rate basis, gain if they can get away with over-reporting. The travelers (I.D. for a batch of work) are handled very badly at this time. For example, a lot size on a skill-saw casing is 500. This casing may have ten to twenty operations done on it before it can go to finished parts stores. At present proper control is lacking and workers can get paid for the entire lot regardless of the number actually worked on. Some pieces may get damaged or lost in the early operations, but these pieces aren't subtracted from the size of the batch. The result is that payment is made based on the original lot size. Hollister is attempting to alleviate this problem by spot inspections (see PROPAC--Exhibits 2 and 3) to check on the quantity reported vs. the quantity physically on hand. Disciplinary action results if one worker consistently is caught over-reporting. Even with these controls managers want a more accurate count of what parts are being worked on, how many have been scrapped, and where particular parts are in the job shops. It is hoped that the reintroduction of data collection can get this necessary information.

Now introduction to data collection appears much different than in 1975. A pilot study on one part (there are 1500) and in one shop (there are 7) is now in progress. In charge of this project is an assistant MIS manager, Ken Davis, who, in conjunction with the shop foreman and the bookkeeping clerks, is gently explaining and trying out data collection. A summary of the implementation method follows:

Objectives

The primary objective of the proposed timekeeping system is to obtain instantaneous quantity control and accurate reporting for finance purposes.

Advantages

Managers feel the new system has the following advantages:

1 Eliminates "blank check" time tickets

2 Reduces writing by the worker in that he now will have only to enter the amount of pieces finished instead of lot numbers, dates, and all the previous detail he used to have to write.

3 Yields more accurate input to PROPAC or removal of the need for PROPAC. (PROPAC is a control system described in Exhibits 2 and 3)

4 Reduces the need for a daily time ticket audit

5 Permits precise knowledge of the WIP Inventory in each department and its location

6 Provides compatibility with future systems

General Procedures

A Using the master production schedule, SCAR (Schedule and Accomplishment) reports, and individual shop production schedules, the dispatcher will enter a production run using a terminal. The entry of a part number will display the steps on the CRT necessary to complete production. A printer terminal will be used to obtain a hard copy traveler to be routed with the lot.

A timekeeper in each department will use a terminal to make any changes necessary in the production order, e.g. a change in components, quantities, etc.

B Using a master department Production Control Schedule printed by the computer, and the SCAR report, the foreman will assign the work.

C The worker will bring the work traveler to the terminal and indicate that he/she has started on operation X. This can be at the worker's convenience when he/she sees the terminal is clear; thereby avoiding queues.

D After completing or partially completing a lot(s), the worker will enter on the terminal his name, plant number, and quantity. During the shift, the timekeeper will record the completion or partial completion on the control traveler. (If there is a lost traveler, the timekeeper's copy can be duplicated.)

E When all operations in the department are complete, the timekeeper will set the traveler aside for production control pick up, matching, and shipment to the department performing the next operation. It is the responsibility of production control to see that the timekeeper gets the control traveler when parts enter a department.

F When quality control or the set-up man rejects parts, a copy will be sent to the timekeeper to check and update her travelers and computer records. From that point the quantity produced and reported cannot exceed the adjusted traveler sub lot quantity.

Introduction of System

A The MIS approach is to implement the system on one product category at a time within one supervisor's authority. We intend to start in Leon Rumelt's department and will use the band-saw blade for our pilot study.
   1 The blade has most of the important complications such as relotting twice, and leaves department 7751 later to return (see Exhibit 5).
   2 Because the system is compatible with the present payroll system, we can work on one product even though the employee may work on items other than the band-saw blade.
   3 An MIS manager shall instruct the timekeeper during the pilot study.
   4 When the system is working well on the saw blade, and we have resolved unforeseen problems, we will expand the system to other parts.

Exhibit 5
HOLLISTER MANUFACTURING
Traveler

TRAVELER

Drawing Number		Plan Date	Component Description	Set Up Qty	Issue Date	Page	Line & Type	Product Struct	Planner	Quantity Released
7751 C J A 553A2309P99	00	512	BAND SAW BLADE	000000	620	0001	150	HAA	290	31891

Stock Area	Material Spec		Plan Date	Reference	Usage Factory	U/M Factory	Usage/C Cost	U/M Cost	Shop No Acct Cont	Quantity This Sub Lot	Rel No	Sub Lot No
7411 0	FRMBA1G610	00	512	34-34-	0000	00	009250	LB	8010		006	

			Operation Description		Plan Date				Mach Code	Job Rate	Oper No		Dispatch Index: Number of Pieces	Clock Number	Date	Number of Pieces	Clock Number	Date
7735		020ABB	CUTOFF	00	538	A	C	P	FAE	600	020	B						
7734		030PAB	TUMBLE	00	512	A	E	O	ODA	530	030	B						
7751		040ACB	GRIND	00	512	C	S	O	GDA	670	040	B						
7751		060AEB	DRILL	00	512	C	S	X	DBC	670	060	B						
7753		080AFB	BROACH	00	512	C	S	P	BFA1	530	080	B						
7751		090?SB	WASH	00	512	C	S	O	NAA	740	090	B						
7751		100?EB	C SINK BLT HL	00	512	C	S	P	TDC	740	100	B						
7751		110AVB	DEBURR	00	512	C	S	P	NBB	740	110	B						
7751		130AJB	BORE	00	512	C	S	P	IBA	670	130	B						
7751		140?HB	DRL KNK OUT H	00	520	C	S	X	CBA	670	140	B						
7751		160?ZB	FILE	00	512	C	S	P	NBB	740	160	B						
7441		998 B	SEND TO STORE	00	512						998	B						

Exhibit 6
HOLLISTER MANUFACTURING
Job Card

DEPT	ACCOUNT NUMBER	DWG #	OPR#	AUTH.QTY	REL

JOB CARD

NAME	PLANT NO.	QTY	COMPLETED YES	NO
H JONES	9781	448	Y	N
			Y	N
			Y	N
			Y	N
			Y	N

DATE		
INC.RATE	$	STANDARD RATE
		5827
HRS. WKD		LOT NO.
H TIME/%		C TIME

B <u>Key Points</u>

1 The foreman assigns the work to the worker, much as he does today, but with this system proposal, the assignment is more positive.

2 The system, as it is proposed, is a prototype for systems of the future.

3 The program suggested is a safe, gradual implementation. We will have ample opportunity to verify that the system is working well at each stage of implementation before going on to the next stage.

4 It would be foolhardy to underemphasize the amount of input required by the proposed system. The major weakness of the system being proposed is that it requires careful input of a large number of transactions.

5 The control traveler (Exhibit 5), which is specified by this procedure, is being used in the early stages of procedural development to provide a handy reference to determine where any job is at any time during the day. It will also provide a clear visual trail for the progress of individual lots through the manufacturing process. However, the control traveler does little more than duplicate information contained in the computer. Therefore, if input eventually becomes sufficiently routine and sufficiently accurate, we may be able to dispense with the control traveler.

6 There is very little incentive for the worker to report the fact that he is starting to work on a lot of material. To get the workers to enter data on a particular lot requires strict discipline.

C The following are the major needs to assure a successful implementation of the proposed system.

1 The cooperation of foremen and employees is needed, and we must emphasize the need for the foremen to exert discipline. When data is entered for a quantity greater than that which was authorized, the foreman must speak to the worker and insist that the last man who worked on the job will not be paid for the over-reported quantity. Without this discipline, we will get none of the advantages of the proposed system.

2 Production Control must handle and control the computer travelers.
3 The timekeeper and workers must learn to input data.

It is crucial to Jim Martin and Gordon Browning that this pilot study is effective. The MIS and CD groups cannot afford problems similar to the information gathering attempt of 1975. The confidence of operations management was badly shaken then, and it has been slowly regaining such only through a long and painful struggle by MIS and CD personnel.

APPENDIX: Additional Design Data
by Jim Sutton

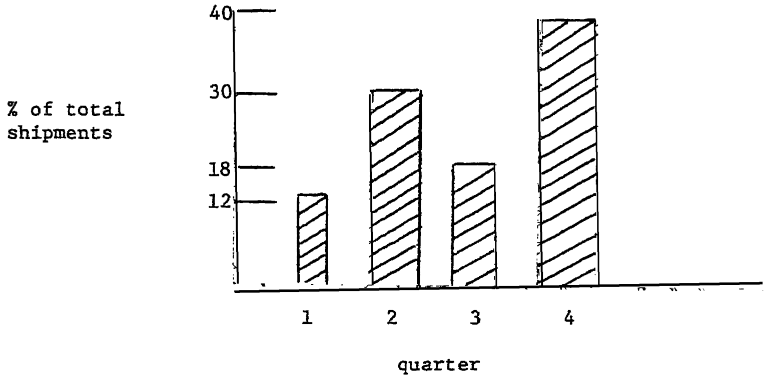
ORDER FLOW

As a general policy, Hollister maintains each incoming order as a separate entity from the time it is originally received until the order is shipped in one or more shipments. At the time of shipment, an invoice is generated for each order. One entry is made to the Accounts Receivable's system for each shipment. The number of shipments per order breaks down as follows:

# shipments	% total orders
1	96
2	3
3	1

In terms of accounts receivable, about one quarter are paid in two or more installments. The average number of cash applications required per invoice is 1.4.

Activity among products and customers is highly variable. Eleven per cent of the customers account for 76% of the output of the Flint plant. The number of orders per customer remains essentially constant, and there are about 10,000 orders per year. Last year, Hollister shipped to 197 customers. Forty per cent of the product types produced by Hollister account for about 75% of the sales, and the demand is seasonal as shown on the following page.



Hollister has compiled some statistics concerning the operations of their seven manufacturing and three assembly shops. These statistics are summarized below:

Manufacturing Shop	% of total tools produced entering shop	# of employees	# of parts produced per year (X 1000)	Average lot size	Average # of operations this shop
Electric Motors	21	100	210	50	36
Air Motors	6	20	60	10	30
Case Machining	92	150	1,100	250	24
Gear Ship	27	75	540	100	46
Metal Coating	40	55	480	100	7
Wood Parts	26	10	280	100	13
Small Metal Parts	85	80	1,700	100	13
Assembly Shop					
#1	42	22	N/A	100	27
#2	30	15	N/A	80	36
#3	28	14	N/A	100	27

The actual size of any given lot is determined by the specific part being produced or product being assembled. The lot size for each part/product at any given manufacture or assembly stage is maintained on a card space file kept by the timekeeper. He manually looks up the lot size for entry on travelers or job cards.

When an order has been completed, each item is given a final inspection. About 2% of the items are found defective and are returned for rework or scrap. The returned items are made up out of inventory. The completed order may then be sent via a variety of commercial carriers to the customer. Approximately 2% of the shipped items are returned to Hollister as defective (either through shipping damage or undetected manufacturing defects). Of all defective items, about one-half are scrapped and about one-half are reworked. Reworking involves about one-third the time required to produce a new unit.

Priority of shipment, in the case of low inventory, is generally made on the basis of an externally assigned customer priority. However, Management feels it must have the ability to assign high priorities to certain individual orders. Not only must Management be able to change priority, but it wants positive control over items produced. Hence, concern exists over the fact that 30% of the items are "relotted" at least once in the production cycle and 5% are re-lotted twice. (Remember, re-lotting means that an item originally in one lot is transferred to another lot. This transfer usually takes place because of differing lot sizes between shops or operations space or because of physical handling methods lumping items of several lots together.) Management feels the second re-lotting can be curtailed through more stringent controls but that the first re-lotting is probably necessary. Re-lotting because of physical handling methods accounts for 42% of all re-lotting. Because of differing departmental standards, about half of the parts produced change control numbers between departments.

Hollister has also acquired some information useful for any future systems designers. Additional comments on some important Management requirements are included in the data below.

- About 10% of any type of manually punched input cards are rejected by programmed edits.
- Management requires that the answer to any inquiry

regarding order status, accounts receivable, or inventory be answered within a reasonable time. Status as of the last report period is considered sufficient.

- Production start schedules may not be modified once a weekly schedule is started.
- Overstatement of production has occurred in about 4% of the cases checked.
- Raw materials are very cheap with respect to the cost of labor and the finished product. Hence, no problem of raw materials inventory control exists.

DYCO Chemical Corporation (A)

John S. Hammond III

On January 25, 1971 Walter Schroeder, Assistant Manager of the Economic Analysis Department of DYCO Chemical Corporation (pronounced "Dye Coe") was about to write a memorandum proposing that his department develop a computer model of the company for forecasting and financial planning. Developing a corporate model had been on his mind for some time, but his department had always been too busy to begin the project. Mr. Schroeder, having just returned from a seminar on cash flow computer models conducted by Data Resources Inc., an economic consulting firm, now had new enthusiasm for the project.

DYCO INCORPORATED

DYCO, headquartered in Newark, New Jersey, was a diversified producer of chemicals with world-wide sales of nearly $470,000,000 in 1970. The company was incorporated as the National Dye Company in 1914 to fill a void caused by the interruption of dye supplies in World War I. I. G. Farben, a German manufacturer of dyes and chemicals, had dominated the U.S. dye market with its strong patent position until 1914, when the patents were ignored and a new U.S. industry was created. With the United States entry into the war in 1917, the company began to manufacture gunpowder and explosives. National Dye diversified into chemicals and other products in the 1920s using the trademark DYCO on many of its products. In 1965 it changed its name to DYCO Chemical Corporation to better reflect its wider product line. It had plants in 27 U.S. locations and subsidiaries and affiliated companies in 17 foreign countries.

DYCO was organized into operating divisions which were responsible for the production and sale of products, and auxiliary divisions which provided services to the operating divisions and to the corporation as a whole. In 1971 there were eight operating divisions: Paint and

Other Coatings, Explosives, Rubber Products, Plastics, Textile Products, Basic Chemicals, International, and Entrepreneurial Enterprises. The principal products and 1970 sales of each of these divisions are listed in Exhibit 1. The operating divisions were in turn divided into departments and product groups.

The service divisions were Accounting and Administration, Advertising, Computer Services, Engineering, Legal, Patent, Personnel, Purchasing, Traffic and Treasurer's. The expenses associated with these divisions were charged to the operating divisions as part of corporate overhead (with the exception of Computer Services which were billed on an as-used basis).

As the company diversified over the years and as its product line evolved, its organizational structure changed, the most recent reorganization being the 1970 consolidation of four of the ten existing divisions into two.

The company's sales had increased each year during the past decade, roughly doubling during the period. Although net income had been more volatile than sales, the company had been profitable in each of these years. DYCO ranked among the top 20 U.S. chemical companies in sales, profit margin and return on investment. In 1970 it spent $13 million on R&D and $55 million on capital expenditures, and it ranked among the top ten chemical manufacturers in capital expenditures over the last five years. A ten-year summary of its key operating and financial statistics is shown in Exhibit 2. The percentage of business done in each of the principal industries to which the company sold commercial products is shown in Table 1.

Table 1

Breakdown of 1970 Commercial Sales to Industries

Plastics	13%	Automotive and parts	4%
Rubber	10%	Electrical and electronics	3%
Synthetic fibers	10%	Ordnance and accessories	2%
Textiles	9%	Soap and detergents	2%
Protective coatings	7%	Petroleum	2%
Food	5%	Paint	2%
Agriculture	5%	Stone, clay, glass	2%
Miscellaneous chemicals	4%	Construction	2%
Mining and quarrying	4%	Other industries	14%

TOTAL...100%

Exhibit 1

DYCO CHEMICAL CORPORATION (A)

Principal DYCO Divisions, Their Products and Approximate 1970 Sales

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PAINT AND OTHER COATINGS DIVISION ($35 million)

Pigments: Inorganic and Organic Pigment Colors, Organic Dyes, Color Lakes and Toners, Pigment Dispersions, Ceramic Colors, Cadmium Colors, Magnetic Iron Oxides.

Coating Materials: Nitrocellulose, Chlorinated Rubber, Nitric Acid.

Industrial Finishes: Enamels, Lacquers, Priming Agents.

EXPLOSIVES DIVISION ($83 million)

Industrial Groups: Dynamites and Gelatins, Seismic Explosives, Blasting Agents, Fluidized Explosives, Blasting Supplies, Electric and Regular Initiators and Detonators, Explosives-grade Ammonium Nitrate, Nitric Acid, Mixed Oxides of Nitrogen, Smokeless Powders for Sporting Use.

Government Sales: Gas Generators, Military Ordnance, Smokeless Powders.

RUBBER PRODUCTS DIVISION ($87 million)

Automotive: Belts and Belting, Hose and Tubing.

Other: Latex Foam Rubber, Coated Fabrics.

Rubber Chemicals: Emulsifiers, Para-Menthane and Diisopropylbenzene Hydroperoxides, Synthetic Rubber.

PLASTICS DIVISION ($56 million)

Resins: Acrylics, Polyester, Nylon.

Plastic Products: Plastic Containers, Speciality Products --Injected and Formed Foam--Sheet and Bun, Industrial Tape.

TEXTILE PRODUCTS DIVISION ($37 million)

Fibers: Nylon and Acrylic.

Film: Polyester and Acrylic Films.

BASIC CHEMICALS DIVISION ($90 million)

Agricultural Chemicals: Insecticides, Pre-emergence and Post-emergence Herbicide, Anhydrous Ammonia, Urea, Prilled Ammonium Nitrate, Ammonium Nitrate and Urea-Ammonium Nitrate Solutions.

Exhibit 1 (Continued)

Other Chemicals: Plasticizers, Pentaerythritol, Methanol, Formaldehyde, Para-Cresol, Alpha-Methylstyrene.

INTERNATIONAL DIVISION ($47 million)

Responsible for foreign sales, foreign investments, and the management of DYCO interests in foreign subsidiaries and associated companies in Argentina, Australia, Belgium, Denmark, England, France, German, India, Italy, Japan, Mexico, The Netherlands, New Zealand, Nicaragua, Spain and Sweden.

ENTREPRENEURIAL ENTERPRISES DIVISION ($45 million)

Responsible for initiating new business opportunities by commercializing new products from company research, purchasing or licensing technology outside the company, or by acquisition, merger, or joint venture.

Exhibit 2

DYCO CHEMICAL CORPORATION (A)

Ten Year Financial Digest

Year	Current assets	Current liabil- ities	Property, plant & equipment: Gross	Property, plant & equipment: Net after deprec- ciation	Other assets	Reserves other than depre- ciation and doubtful accounts
			Financial review (thousands of dollars)			34,754
1961	82,160	33,121	199,331	96,847	26,224	34,754
1962	91,682	34,827	215,663	101,135	31,204	39,599
1963	106,417	36,379	231,243	103,414	33,053	43,755
1964	112,405	36,667	245,529	102,616	32,809	42,157
1965	113,590	39,475	283,277	123,861	42,937	41,741
1966	151,676	69,839	319,925	145,481	29,588	41,269
1967	141,544	61,560	390,686	200,400	45,265	38,749
1968	154,565	82,781	448,861	236,521	49,360	37,573
1969	164,880	88,868	481,483	242,986	52,134	36,850
1970	181,414	98,693	500,346	255,658	53,578	36,150

Year	Net sales	Income before taxes on income	Income taxes	Net income
Operating review (thousands of dollars)				
1961	247,752	38,398	20,830	17,568
1962	296,619	42,971	23,278	19,693
1963	313,756	42,458	22,008	20,450
1964	328,795	44,822	21,700	23,123
1965	330,676	47,274	21,228	26,046
1966	379,342	60,269	28,204	32,065
1967	385,575	51,220	23,237	27,992
1968	430,984	58,493	26,492	32,002
1969	447,595	48,711	22,345	26,366
1970	470,165	55,775	26,032	29,743

Exhibit 2 (Continued)

Year	Net income	Provision for depreciation and amortization	Increase in long-term debt	Other	Total
Working capital analysis--source (thousands of dollars)					
1961	17,568	14,897	0	7,697	40,163
1962	19,693	16,951	0	4,816	41,459
1963	20,450	16,531	0	7,954	44,935
1964	23,123	17,596	0	1,924	42,643
1965	26,046	19,156	21,000	5,829	72,031
1966	32,065	21,043	15,000	5,445	73,553
1967	27,992	22,235	59,700	6,853	116,780
1968	32,002	27,915	33,600	6,266	99,783
1969	26,366	30,797	-16,132	36,626	77,657
1970	29,743	32,150	3,373	32,786	98,053

Year	Expenditures for property, plant and equipment	Dividends	Other	Total	Working capital at end of year
	Working capital analysis--use (thousands of dollars)				
1961	27,118	7,646	-172	34,592	49,039
1962	22,469	8,845	2,328	33,643	56,855
1963	19,298	8,992	3,462	31,753	70,037
1964	17,443	11,631	7,868	36,943	75,737
1965	40,773	11,724	21,156	73,653	74,115
1966	41,832	12,971	11,029	65,831	81,837
1967	77,780	14,254	26,568	118,633	79,984
1968	65,550	14,320	28,114	107,983	71,784
1969	38,155	14,300	20,975	73,430	76,012
1970	54,610	14,234	22,499	91,343	82,721

Exhibit 2 (Continued)

Year	Number of common Stockholders	Average number of employees	Wage, salary, and benefit costs	Pension and social security costs	Res'ch expend-itures	Export sales from the United States
			General statistics (thousands of dollars)			
1961	10,554	10,528	80,647	6,999	7,844	29,288
1962	11,988	12,235	97,114	8,398	8,168	29,039
1963	12,394	12,997	104,455	9,174	8,582	28,692
1964	12,663	13,238	113,992	9,907	9,913	35,093
1965	13,722	12,898	113,927	9,748	11,237	34,277
1966	14,336	13,028	124,585	13,136	12,455	40,993
1967	14,682	13,093	128,851	12,539	12,881	45,936
1968	14,408	13,494	137,849	13,395	14,002	46,516
1969	14,768	13,678	143,366	13,049	13,939	45,936
1970	15,327	13,267	148,512	14,066	12,952	56,782

Year	Earnings	Dividends	Average of high & low prices for DYCO stock
A common share (adjusted for stock splits)			
1961	1.26	0.52	37.90
1962	1.40	0.60	31.95
1963	1.41	0.60	31.05
1964	1.61	0.80	35.00
1965	1.80	0.80	35.65
1966	2.18	0.88	34.45
1967	1.90	0.96	38.30
1968	2.15	0.96	36.05
1969	1.77	0.96	33.55
1970	2.01	0.96	27.35

MANAGEMENT STYLE AND CORPORATE GOALS

One manager at DYCO described relationships among the top management as "gentlemanly." Problems were discussed as an exchange of ideas among peers and persuasion rather than directives was used to affect performance. The top management of the company had known one another for a long time and all but two had risen to their positions through the ranks.

The President of DYCO, William Reynolds, had joined the company as a research chemist in 1940, when he graduated from the University of Virginia. He moved up through a variety of supervisory and marketing positions until he became general manager of the company's Rubber Products Division in 1960, a member of the board of directors in 1963, and a corporate vice president in 1965. In December 1969 he was elected President and Chairman of the Executive Committee. Articles in the trade press described him as "soft spoken and optimistic," a "calm, size-up-the-situation-before-making-a-move type," who was bent on guiding the company in new directions. This would be accomplished not only by upgrading its traditional chemical products but by entering new and unrelated product areas. Chemicals, which then represented close to 90% of total sales, were expected to represent 60%-65% of the sales in 1980.

Spearheading the diversification effort was the Entrepreneurial Enterprises Division. Its charter gave it three areas of responsibility:

1 To spend 10%-15% of the corporate R&D budget examining technical areas unrelated to the company's present activity.

2 To conduct a world-wide search for technological breakthroughs by smaller firms lacking financial resources to capitalize on them.

3 To look for acquisitions of larger companies that fit well with DYCO's current operations, offered an immediate earnings per share contribution, and had a growth rate at least as great as DYCO's.

Among the new areas the company had entered were urban planning, pollution control and ultra-sonic security systems.

Mr. Reynolds thought of the company's traditional products as falling into three categories: "growth" products growing at more than 10% a year which he expected to

account for more than 50% of DYCO's sales and earnings by 1973; "cyclical" products such as phenol and formaldehyde which he expected to grow in proportion to the gross national product; and "turnaround" products such as explosives and nitrogen which he expected to rebound with the next 3 years or face the possibility of being divested. DYCO had recently divested itself of one of its turnaround product plants and had sold its joint venture interest in an unprofitable foreign subsidiary.

Soon after taking office Mr. Reynolds visited all the company's U.S. plants and initiated a cost-cutting program aimed at increasing sales without a corresponding rise in indirect costs. He also expressed the opinion that market share should not be a deciding factor in future pricing policies; he was determined to get prices up in some of the company's important product areas. Mr. Reynolds described himself as a generalist and said, "I encourage constructive criticism. A bunch of yes men scare me to death. After I have listened I try to make an honest decision."

DYCO's Executive Committee served as an extension of the president to control the direction of the company by controlling investments. It also played an important role in deciding how much to spend on research, in establising budgets, and in setting wage and salary guidelines.

THE ECONOMIC ANALYSIS DEPARTMENT

The role of the Economic Analysis Department, organized in 1937, originally was to make forecasts of the national economy. Always a department of the Treasurer's Division, its role gradually expanded first to industry and market forecasting, and during the early 1950s to consolidating long-range forecasts of the corporation's operations. In more recent years it had assumed the responsibility of evaluating proposals for large capital outlays and doing more detailed forecasts of DYCO operations. Its responsibilities included consolidation and review of the three-year strategic plan; preparation of one-month to three-year DYCO sales and profit forecasts; economic analyses and forecasts of industries, markets, and general business; analysis of DYCO performance; review of divisional financial data; analysis of real estate operations; financial analysis of appropriation requests; analysis of mergers and acquisitions; review of divisional budgets;

special financial and economic studies; and maintenance of data for statistical analysis. In short, its role was that of collector, producer, interpreter, analyzer, and evaluator of forecasts, proposals and information relating to strategic resource allocation by top management.

For example, the Economic Analysis Department evaluated all major capital expenditure and acquisition proposals (those whose cost exceeded $500,000) and filed a report to top management. The division filing the appropriations request used a 10-page form whose key elements are outlined in Exhibit 3. The job of the Economic Analysis Department was to examine the assumptions, forecasts, and risks inherent in each of these proposals and to play a devil's advocate role on behalf of top management.

As Mr. William Kirkpatrick, Department Manager, put it, "The operating divisions may be correct when they call us 'nay sayers,' but we have a basis for each position we take. After all, they are out to sell and advocate their proposals and their egos are involved; someone has to keep them honest."

The Economic Analysis Department sometimes adjusted the forecasts presented by the divisions in their proposals and plans when it believed they were too optimistic. It was rare indeed when the forecasts of the divisions were deemed too pessimistic. It found that the divisions in rapidly growing markets tended to be too optimistic in their forecasts while those in more stable markets were more realistic.

The department played an important role in the planning process; little planning information went to top management that did not also pass through it. Mr. Kirkpatrick also gave quarterly presentations to the board of directors on the national economic outlook. He felt that the Economic Analysis Department had a reputation with management for reasonable, well-thought-out analysis. Top management tended to call directly on the Economic Analysis Department for information and requests to do studies rather than going through the Treasurer. Such calls were received at least several times a week and often daily. The same confidence existed within the Treasurer's Division; Mr. Kirkpatrick described the Treasurer as "very supportive of our efforts and a very forward looking guy."

In addition to forecasts designed for evaluating a specific proposal, the Economic Analysis Department was

Exhibit 3

DYCO CHEMICAL CORPORATION (A)

Contents of Pages of DYCO Appropriations Request Form

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1. Face Sheet
   Name of project, plant department, amount of expenditure, physical completion date, ready for use date, basis of request (Profit, Savings, or Other).
   Narrative:
   1. Why is project needed?
   2. What is proposed?
   3. Who will project pay off?
2. Reason Sheet
   Narrative
   1. Present facilities?
   2. Why they are inadequate?
   3. What is proposed under this project?
   4. Are all necessary auxiliary and pollution abatement facilities included?
   5. To what other capital expenditures will this project commit us?
   6. What facilities are to be abandoned, and proposed disposition?
3. Savings-based Request Sheet
   a. A detailed breakdown (for a single year) of the cost components of the production operation and space for three columns of figures following each cost component:
      Unit Cost if Project is Not Authorized — Unit Cost if Project is Authorized — Savings Due to Project
   b. Earnings by Calendar Years: Consists of statement of earnings and assets employed (for a single year) in the operations before and after the appropriation indicating the economic effect of the appropriation. Has allowances for two-year startup time. Requests calculation of profit after tax as % of operating assets.
4. Detail of Net Sales
   Breaks down projected sales revenue and prices by year according to inter-company and external sales. Shows difference between current and projected sales.

Exhibit 3 (Continued)

5. Production Cost Estimate
   Breaks down projected costs by year. Shows difference between current and projected sales.
6. Indirect Cost Estimate
   Breaks down indirect costs by year showing difference between current and projected levels. Among the categories: Advertising, branch office expense, net commissions, engineering, home office, departmental research, technical sales service, and net royalties.
7. Market Analysis Data
   Narrative to summarize applying the Division's current knowledge and indicating the sources and scope of its investigations covering:
   1. Estimated Volume and Rate of Growth of Sales
   2. Estimated Prices and Anticipated Price Changes
   3. Competitive Products, Existing and Potential
   4. Comparative Products, Existing or Potential, and how their costs are believed to compare with DYCO's
   5. End Uses, Breadth and Location of Market
   6. Penetration of Market, Existing and Potential
   7. Effect on Present DYCO Products
   8. Any other Factors which are Pertinent
8. Basis of Estimate
   Narrative: applicant asked to state
   1. Product
   2. Capacity
   3. Use to be made of existing facilities
   4. Plan for execution of project
   5. Quality of Estimate
   6. Description of proposed facilities
9. Cost Estimate of Investment
   Breakdown of construction costs of the requested facility.
10. Distribution of assets by Product
    Breakdown of use of assets by type of products.

responsible for a hierarchy of general forecasts from very short-range to long-range. These were made for top management at regular intervals. In the short term the department made forecasts of sales and gross profit by product group three times each month: at the beginning of the month, at mid-month, and at the end of the month. (The actual monthly figures became available the middle of the following month.) These forecasts were used primarily to monitor the company's earnings per share record.

Every quarter the department forecasted income statements, balance sheets and sources and uses of funds for each of the next four quarters for the corporation, divisions, and occasionally for the product groups. These forecasts were used for management of cash, receivables, inventories and debt.

Finally, there were the long-range forecasts of corporation income statements and balance sheets extending three years into the future. These were used in long-range planning including such things as financial management and new products. At each level of forecast, short-range, intermediate or long-term management expressed strong interest in earnings per share. The department's record in forecasting is summarized in Exhibit 4.

The staff of the Economic Analysis Department consisted of thirteen people whose background and specialities are listed in Exhibit 5. Each person tended to specialize in a few areas, but also became involved in projects outside his specialites because the department was a small one.

Only two members of the staff, William Kirpatrick and Oscar North, had strength in developing computer programs, although all members of the department had used the computer at various times in their work. Because of the lack of computer expertise within the Economic Analysis Department and because DYCO had a centralized Computer Services Division, the Economic Analysis Department had tended to rely on the Computer Services Division for its computer programming. Over the years Economic Analysis Department personnel had developed close relationships with people within the Computer Services Division and tended to work with the same people on successive programs. However, the arrangement had been less than ideal because the Computer Services personnel were accounting oriented and uneasy with statistical concepts and because of slow turnaround times on the company batch processing computer. When the

Exhibit 4

DYCO CHEMICAL CORPORATION (A)

Accuracy of Forecast by Economic Analysis Department

Quarter forecasted	% deviation of forecast from actual				Actual sales
	4 quarters ahead	3 quarters ahead	2 quarters ahead	1 quarter ahead	($ million)
	A. Quarterly forecast of non-governmental sales				
1Q 1968	2.6	1.5	-4.3	-4.6	85.3
2Q	3.7	0.4	-0.2	-2.4	95.6
3Q	-3.8	-7.9	-5.9	-2.5	98.8
4Q	-7.2	-10.1	-7.3	-4.6	100.7
1Q 1969	-4.8	-4.3	-1.9	-1.1	96.4
2Q	3.6	-0.5	4.0	5.8	103.2
3Q	6.0	4.6	10.3	3.2	101.2
4Q	1.4	8.1	2.1	0.5	104.0
1Q 1970	8.7	1.6	-0.2	0.5	103.0
2Q	4.5	3.7	-1.5	1.7	107.6
Average absolute deviation	4.6	4.3	3.8	2.7	

Year fore-casted	Earnings per share--% deviation of forecast from actual						
	Forecast 7/2/64	Forecast 6/30/65	Forecast 6/30/66	Forecast 6/22/67	Forecast 1/15/68	Forecast 1/17/69	Forecast 2/6/70
	B. Long-range forecasts of annual earnings per share						
1964	-4.0						
1965	-8.6	-6.3					
1966	-18.4	-19.1	-11.2				
1967	-1.7	+2.5	1.3	6.3			
1968	-8.2	-9.7	-5.9	6.3	6.7		
1969	18.1	20.4	22.6	41.6	33.5	29.0	
1970	9.2		16.3	40.2	39.8	27.5	4.4

Exhibit 5

William Kirkpatrick, 35, Manager, B.S. Electrical Engineering, University of Pennsylvania, and MBA, Harvard Business School. Three and one half years in finance and international business with Union Carbide. Joined DYCO February 1966 in the Engineering Division. Originated an engineering systems and methods group which dealt with systems for cost control, materials control and scheduling of engineering projects. Worked on forecasting capital expenditures. Became quite familiar with computers. Entered Economic Analysis Department March 1969 as analyst; became Department Manager November 1970.

Walter Schroeder, 55, Assistant Manager, B.S. Economics at Ohio State University. Five years teaching economics and statistics at Ohio State University prior to joining the Economic Analysis Department in 1951. Master's degree and course work for Ph.D. completed along with several "half theses." Originally hired to make industry studies. Now specializes in industry market forecasts and reviewing appropriate requests. Considered to be the strongest man in the Department in general economics and statistics.

Peter Greene, 40, Statistical Analyst, B.S. and M.S. Economics, Rutgers University. Joined the Economic Analysis Department in 1960 directly out of Rutgers; specializes in general economic forecasting on the aggregate level and some market analysis. Moderate experience in econometric modeling; primary liaison man with DRI and the main user in the Department of the DRI system.

John Thornton, 53, Statistical Analyst, B.S. Accounting at Rutgers. With DYCO for 30 years, primarily in accounting and finance before joining the Department in 1969. Specializes in budgeting of indirect expenses and in analysis of real estate markets.

John Murphy, 54, Senior Economist, High School Graduate. Joined the Economic Analysis Department of DYCO in 1938 right out of a business-oriented high-school course. Does general business forecasts and consolidates the three year

plans. Prepares forecasts of general economy; prepares talk given by Mr. Kirkpatrick quarterly to Board on general business conditions and prepares written presentations of forecasts. Maintains the Department "data base" of general business statistics.

Oscar North, 38, Statistical Analyst, B.S. Chemical Engineering, Utah State, and MBA in finance and control, Temple University. Formerly in industrial engineering at the plan level in DYCO. With Economic Analysis Department less than a year. Brought to Department to handle increased load of reviewing appropriation requests. Considered to be the Department's authority regarding the reality of assumptions involving Industrial Engineering or Chemical Engineering. Has computer background; is comfortable in working with time sharing computers. Is comfortable but not expert programming in the BASIC language.

John Howard, 51, Financial Analyst, B.S. Accounting, Rutgers. A CPA, he had been the manager of an accounting department at the plant level before joining the Economic Analysis Department. Seventy five percent of his time was spent evaluating mergers and acquisitions. Considered to be the Department's accounting expert.

Bob Cleveland, 48, Statistical Analyst, Certificate, Newark Business College. Joined the Department in 1947. Has done or been involved in nearly all Department activities. Maintains the Department's "data bank" of measures of DYCO physical volume. Does comparative analysis of current operating results. Prepares a price index of company sales to convert them from dollars to physical terms.

Walter Stevenson, 57, Statistical Analyst, High School Graduate. Originally worked for George O'Brien, the founder of the Economic Analysis Department, when Mr. O'Brien was with Standard Oil of New Jersey and moved to DYCO with Mr. O'Brien. Has done or been involved in nearly all Department activities. Maintains the Department's "data bank" of DYCO financial information. Produces forecasts of financial statements.

Exhibit 5 (Continued)

Jim Dooley, 26, B.A. Economics, University of North Carolina. Has completed course work for Master's degree in economics. Joined the Economic Analysis Department in 1968. Has no permanent, on going responsibilities, but tends to do special studies on such areas as productivity and indirect expenses.

Hazel Harris, 39, Statistical Clerk, High School Graduate. Works with Mr. Cleveland in producing price indices. Does many of the calculations for the Department using a desk calculator.

Dot Baumgarten, 23, Secretary, High School Graduate. Does general secretarial work. Inputs data into the time sharing computer terminal when requested by Department personnel.

Kathy Kowalchuk, 22, Secretary, High School Graduate. Does general secretarial work and is learning to work with time sharing system.

department signed up for an economic forecasting service provided by Data Resources Inc., it gained access to a time-sharing computer, and because of the fast turnaround available from time-sharing, department personnel had made less and less use of the company computer.

Mr. Kirkpatrick's strategy in operating the department was to try to anticipate the types of questions management might ask and to be ready for them. To do its job with a limited staff, the department was continually examining its routine work to cut out unnecessary frills, upgrading its personnel educationally, and looking for new techniques, such as economic forecasting services, time-sharing computing, and computer simulation techniques.

THE DYCO "STRATEGIC PLAN"

Formal planning at DYCO consisted of developing the Strategic Plan, a three-year forecast of activities of the corporation based upon operating plans prepared by each division. Each year the operating plans were prepared and presented to the Executive Committee in a series of meetings which started in September and were held every two weeks until each division had presented its plans.

The steps in the formal planning process were designed to lead up to the Executive Committee presentations. Each operating division submitted its plans to the Economic Analysis Department during the summer and received the department's written critique before its presentation to the Executive Committee. The Economic Analysis Department found it hard to criticize the division's forecasts for individual products, but relatively easier to critique the aggregate sales figures. During the preparation of the plans by individual divisions the Economic Analysis Department would provide information (such as industry forecasts or forecasts of corporate wage rates) when requested, but such requests were relatively rare.

Mr. Kirkpatrick was asked to sit in on all presentations of the strategic plan to the Executive Committee and was frequently asked by the committee whether the presentation was realistic. He also observed that members of the committee often referred to the Economic Analysis Department's critique of the divisions' plans during the presentations.

The contents of the strategic plan itself varied from year to year and in 1971 it consisted of 20 pages of sum-

mary financial forecasts by department and product group. The format of a typical page from the plan is shown in Exhibit 6. In addition, each division prepared a narrative report of 20-100 pages outlining the prospects, problems and opportunities it faced, usually on a product group basis.

Until 1969 the strategic plan had projected five years into the future. It was cut back to three years when the division managers complained that the last two years were a meaningless exercise. Evidence of their complaint was the fact that capital expenditure forecasts for the fourth and fifth years of the plan were always small because the division managers had difficulty visualizing specific projects that far into the future.

The main impact of the strategic plan presentations was informative, letting the committee know of the prospects for each line of business and estimating when proposals for capital expenditures would be made. However, Mr. Kirkpatrick cited a number of decisions that were reached during the sessions. For instance, when the profit outlook for a venture looked poor, the division manager was asked to investigate selling off the business. The Entrepreneurial Enterprises Division was told to concentrate on four of the ten business areas in which it was active becuase the committee felt that the department couldn't do justice to all ten. There was usually a great deal of questioning by the committee during each presentation, especially when a glowing presentation was in conflict with past history for that product or division.

The budgeting process at DYCO was not directly coupled to the strategic planning process although it occurred after ~~the~~ strategic planning cycle. Furthermore, the budget was not comprehensive, since the operating revenues and expenses of individual divisions were not budgeted. However, budgets of capital expenditures were prepared by the Engineering Division and budgets of indirect (GS&A) expenses were prepared by the Economic Analysis Department. The closest thing to budgets of division activities were the quarterly forecasts that were consolidated by the Economic Analysis Department.

The monthly Division Managers Report was the single most important document used in evaluating the performance of the divisions. The report showed unit sales, average sales price, net operating assets, and rate of return on operating assets. Of these figures, the latter tended to get the most attention from management.

PROSPECTS FOR A DYCO PLANNING MODEL

The potential usefulness of a corporate planning model had been recognized by the Economic Analysis Department for some time. The primary motivation had been the need for a top-down forecast to temper the forecast that resulted from the bottom-up consolidation of the operating plans of the individual divisions. A second motivation was the rapid rate of obsolescence of the current long-range forecasts; a new procedure that permitted a relatively quick and inexpensive way of producing new forecasts seemed desirable. From time to time members of the department had discussed the possibility of a corporate model, but the press of other work such as special studies for top management had always postponed the model's development.

In April 1970 the Economic Analysis Department became a client of Data Resources Inc. (DRI), a young firm founded by Harvard Economist Otto Eckstein, former member of the U.S. Council of Economic Advisers, to apply time-shared computer technology to economic and financial analysis. DRI's services centered round on-line access to forecasts of the national economy, data banks, models, and statistical software. These services were supported by consulting, educational seminars, and supplementary contract research. A summary of the services of DRI appears in Exhibit 7.

The heart of the DRI service involved use of the DRI National Econometric Model which is shown schematically in Figure 1. The model consisted of two parts. One, a National Economic Sub-model, took user-supplied assumptions about Federal fiscal and monetary policies and from these projected various measures of national economic activity. The second was the Industries Sub-model which broke the economy down into 81 industry groups and captured the interrelationships and transactions between these industries in an "input-output" matrix. It produced individual industry forecasts based on variables supplied by the National Economic Sub-model. The model produced quarterly forecasts for two years of over 400 economic measures ranging from aggregate figures for the whole economy to the activity of individual industries.

Exhibit 6

DYCO CHEMICAL CORPORATION (A)

Sample Page from the DYCO Strategic Plan:
Forecast of DYCO Performance--1971 through 1973, basic chemicals

	Previous plan	Latest* estimate	Current plan			Previous plan	Latest* estimate	Current plan		
	1970		1971	1972	1973	1970		1971	1972	1973
	Net profit after taxes ($1,000)					Earnings per share ($)				
Pesticides										
Nitrogen Products										
Oxychemicals										
Methanol-Formaldehyde										
Plasticizers										
Adhesives										
TOTAL										
	Total operating assets ($1,000,000)					Return on operating assets (%)				
Pesticides										
Nitrogen Products										
Oxychemicals										
Methanol-Formaldehyde										
Plasticizers										
Adhesives										
TOTAL										

Net sales value ($1,000,000)
Pesticides
Nitrogen Products
Oxychemicals
Methanol-Formaldehyde
Plasticizers
Adhesives
TOTAL

*Plan presented in November so 1970 figures based on 10 months actual and 2 months estimate.

Exhibit 7

DYCO CHEMICAL CORPORATION (A)

Introduction to Data Resources Inc.

DATA RESOURCES INC. was organized to apply time-shared computer technology to economic and financial analysis. DRI services center around on-line access to forecasts of the national economy, data banks, models, and statistical software. These services are supported by consulting, educational seminars, and supplementary contract research. The focus of most customer applications is the integration of developments on the national economic scene with detailed industry and company analyses.

DATA RESOURCES INC. conducts a broad range of economic studies on both technical and policy matters. Through its consulting program, DRI aids clients in the application of modeling techniques and statistical analyses. DRI also analyzes issues affecting the national economy and releases them to the public to aid policy. DRI is a non-partisan organization which does not endorse any political point of view.

Since the DRI system first became available in October 1969, the DRI user group has grown rapidly. Well over one hundred companies, financial institutions, government agencies and research organizations now use the DRI Economic Information System. Users range from highly sophisticated organizations with a large research staff to organizations just beginning to explore the relationship of their activities to the economy who rely heavily on the DRI Consulting and program of Technical Seminars.

DATA RESOURCES services include the following:

FORECASTS
Through use of econometric models, DATA RESOURCES prepares short and long term forecasts of the major dimensions of the American economy. Over four hundred variables, including a detailed breakdown of consumer spending, investment, industry production, financial flows, and various interest rates, are projected with the DRI Econometric Model of the U.S. Economy. Additional forecasts are made using alternative theoretical approaches and relying on other sources

Exhibit 7 (Continued)

of information. Individual analyses of particularly important topics, such as retail sales and airline traffic, are linked to the central forecasts and projected in formats that are tailored to the needs of groups with special interest in this information. The aggregate forecasts are used to develop detailed forecasts of income statements by industry, retail sales by category of output, income, unemployment and housing for specific regions and other indicators of particular interest.

The forecasts prepared by WHARTON Economic Forecasting Associates are also available on the DRI System.

DOCUMENTATION AND SELF-TEACHING
An exceptionally detailed set of manuals for all DRI software is available and makes a self-teaching approach possible. The on-line programs are sprinkled with "help" commands and diagnostic messages to teach the user and aid him through unfamiliar steps.

SERVICE CONSULTING
To assure that users succeed in applying these new quantitative techniques, DRI provides a service consultant program which helps the customer estimate equations, generate forecasts, and link company decisions to overall economic contingencies. The service consultants conduct seminars, work with users on specific analyses, solve technical problems, and train new employees.

CONTRACT SERVICES: ECONOMETRIC MODELLING
DATA RESOURCES will undertake specific model building assignments for subscribers. Particularly in the early stages, some companies prefer to have DRI build the initial models and link them with the economy. Also, DRI occasionally undertakes larger scale studies for which companies do not have in-house resources.

OTHER CONTRACT SERVICES
DRI programming staff will undertake some special purpose software development projects, particularly if they are logical extensions of the analytical methods in the DRI system. DRI will also prepare special purpose data banks

for users and will assist groups of users to coordinate a common research effort.

DRI STAFF

The DRI staff of professionals has grown rapidly. In mid-1971 the staff included fifteen professional economists and analysts and ten specialists in programming and related data processing activities. In addition, a number of nationally known economists are associated with DRI on a part-time basis.

DRI DATA PROCESSING FACILITIES

DATA RESOURCES uses three Burroughs B5500 computers, all located in Lexington, Massachusetts. DRI will install its first Burroughs B6700 computer early in 1972. DRI maintains a nation-wide telephone network through which customers gain access to the computers.

SIMULATION MODELS

The DRI computers contain a collection of simulation models embedded in software which makes it easy to change key policy variables as well as assumptions about the economy itself. These models permit users to develop their own forecasts by substituting their own judgments about key elements. Alternative simulations, prepared both by the DRI staff and by users, also serve as sensitivity tests to indicate the range of possible outcomes for the economy and to measure the possible implications for the production, sales, financial flows, and profits of specific industries.

Simulation models available to customers include:

- the DRI Model of the U.S. Economy in both short-term and ten-year versions
- the Warton 8-Quarter Model of the U.S. Economy
- the DRI-Thurow Growth Model
- the DRI Monetarist Model based on the specifications of the St. Louis Federal Reserve Model
- the DRI Current Quarter Model which converts early monthly evidence and leading indicators into national GNP estimates
- an Equation Bank for forecasting specific magnitudes of special interest to companies and industries

Exhibit 7 (Continued)

DATA BANKS

DATA RESOURCES maintains the largest, continuously updated, on-line data bank of the United States economy. The DRI central data bank is supplemented by other special purpose data banks like Compustat data, Federal Reserve Board flow of funds tables, regional U.S. data, and data banks of other countries. These data banks are coordinated with the proprietary data banks maintained by the user so that the full range of data is available in a common work space

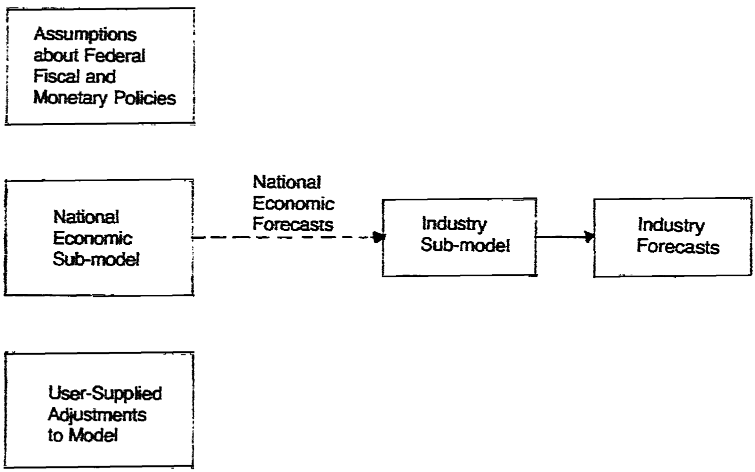
STATISTICAL SOFTWARE

DATA RESOURCES has designed powerful statistical and modelling programs which are easily used without programming training or knowledge of computers. English word commands apply the full range of statistical techniques. Historical relationships, once identified, are readily combined into models. A wide variety of analytical techniques are available, ranging from simple data display, arithmetic, and plotting to spectral analysis, model simulation and Box-Jenkins forecasting.

CONFERENCES AND TECHNICAL SEMINARS

Quarterly Conferences are organized to review the economic outlook with the users, and once a year the long-term outlook projections are reviewed. Periodic seminars and educational sessions train users on the application of quantitative techniques and the use of the DRI System.

Figure 1
DYCO CHEMICAL CORPORATION (A)
Schematic of the DRI National Econometric Model



Because the model was based on a historically-observed normal balance within the economy, it was necessary to make adjustments for abnormal circumstances when they were expected. This was handled by user-supplied adjustments to the variables. In the case of a dock strike for example, the model would overestimate imports and exports. By making adjustments to imports and exports, a user could input his estimate of the strike's impact. The adjustments would then affect other variables in the model, hopefully resulting in a more accurate forecast.

Consequently, there was a great deal of skill required in adjusting for current realities and in deciding upon a set of assumptions about federal fiscal and monetary policies. This managing of the model was done by a staff of economists at DRI. There were several hundred variables for which adjustments could be supplied and a smaller number of fiscal and monetary assumptions, including federal purchases of goods and services, transfer payments and social security taxes, federal tax receipts, the effective corporate tax rate (taking into account the investment tax credit and depreciation allowances), and the rate of growth of the money supply.

New forecasts based on DRI-supplied assumptions were made quarterly and whenever changes in the economic situation (such as the advent of price controls) warranted them. With each new run of the model the DRI economists spelled out their assumptions in great detail. For example, in the September 1971 forecast assumptions regarding future transfer payments and social security taxes were accompanied by a discussion of how the welfare reform issue would be resolved, and the assumptions regarding future tax receipts were supported by a discussion of when the import surcharge would be terminated. The documentation of a run from the model sometimes exceeded 100 pages, about 25 pages of which spelled out the assumptions and the reasoning behind them and the rest of which were forecasts and interpretation. About two weeks after the issuance of each new forecast, DRI held a day-long seminar in which Otto Eckstein briefed subscribers on the assumptions and implications of the new forecast and answered their questions. In addition to the quarterly forecasts, the DRI economists reran the model as new monthly data became available and issued update bulletins.

In the DRI package purchased by DYCO was one day of consulting each month by Fred Bamber, a DRI analyst. Mr. Bamber

was a 1969 graduate of Wharton with a strong background in computers, economic analysis, and a solid knowledge of general business administration. He was highly regarded by Economic Analysis Department personnel. Mr. Bamber had on occasion performed modelling work for his clients under special consulting contracts.

In the back of the minds of those who initiated the DRI contract was the use of the DRI data to construct a corporate model, but no efforts were made to develop a model until January 1971, when Walter Schroeder attended the DRI seminar on computer-based cash flow models.

THE MEMORANDUM

Mr. Schroeder began the work on his memorandum by pulling out a file in which he had numerous notes about a prospective model. He then jotted a list of subjects he wanted to be sure to cover. He wrote:

- Uses
- Output format
- Cost
    - Who should do it
    - Manpower
    - Computer
- Equations

After organizing his notes he began to write.

DYCO Chemical Corporation (B)

John S. Hammond III

In early January 1972, William Kirkpatrick, Manager of the Economic Analysis Department of DYCO Chemical Corporation, was reviewing the company's new corporate simulation model with Walter Schroeder and Peter Green, the men responsible for its development. The model, completed in August 1971, had been developed by Data Resourses Inc. (DRI), an economic consulting firm. The men were modifying and checking the model prior to employing it in the Economic Analysis Department's forecasting and financial planning.

THE EVOLUTION OF THE MODEL

The Economic Analysis Department had been interested in a corporate model for DYCO for some time, but special projects for top management had kept them from starting the project. Development of the model had been given new impetus when Walter Schroeder attended a DRI seminar on cash flow models in January 1971. When he returned to DYCO he outlined his ideas for a corporate model in a memorandum which specified the output he thought the model should produce, speculated on uses for the model, roughly sketched out the needed equations, but also pointed out that there were various gaps to be filled.

In his section called "costs" (reproduced below), he estimated costs and suggested who should do the work.

> Two to four man-months would be a rough estimate of the amount of the Economic Analysis Department's time required to complete a preliminary model. Debugging and tuning could take another one to two man-months.
>
> The effort would draw on all of the people and resources of the department on a part-time basis but it would be important that one person be responsible for its control, direction, and coordination. The model should be the principal responsibility of that person.

Oscar North is one logical candidate, and Jim Dooley is another. Whoever it is would need the assistance of all of us.

The DRI resources required would include use of (1) the DRI and DYCO data banks, (2) the DRI statistical analysis programs, (3) the DRI model, and (4) the DRI model-building package. We would also have to call on Fred Bamber and possibly other DRI people for assistance.

The amount of DRI computer time required would probably be the equivalent of one to three months of our normal use of the DRI data and programs. Two to four of Fred Bamber's monthly visits might also be used on the model.

During the next few months, no work was begun on the model. Mr. Schroeder did, however, discuss his memorandum with Fred Bamber, DRI's consultant to DYCO, who visited the Economic Analysis Department one day each month.

In June 1971 DRI made an unsolicited proposal to the Economic Analysis Department to develop a model similar to the one outlined in Mr. Schroeder's memo. DRI offered to do the work for a fixed fee, plus the cost of computer time. The offer was accepted and the project was started at the end of June.

It was decided that three closely related models would be constructed in sequence, the first two being evolutionary steps toward the third. The first was an accounting model of historical financial relationships at DYCO. The second and third models made deterministic forecasts but each required different inputs. All 3 would produce the following output on a quarterly basis:

1 Income statement,
2 Balance sheet,
3 Cash flow statement, and
4 A series of financial ratios.

They would be constructed on DRI's time-sharing computer.

The three models were the following:

1. The "Accounting Identities Model" would generate a set of quarterly financial statements from the first quarter of 1953 through the last quarter for which actual data was available, and would be updated over time as new data became available. The historical data in the

accounting model would provide the basis for the relationships and estimating equations to be used in the forecasting models. The data would be adjusted to account for major acquisitions.

2. The "Internal Pro Forma Model" would extend the Accounting Identities Model into the future for as many years as the user wished to supply data. This model's forecasts would be based on historical relationships (determined from the Accounting Identities Model) between variables and on levels or rates of change of others of the variables. For example, the relationship between sales and direct costs might be based on historical data while the level of capital expenditures might be assumed to change over time. The principal value of this model would be to allow the user to make assumptions about critical variables in the model and to learn how these changes might be reflected in the other accounts.

3. The "Econometric Model" would be used for forecasting by directly linking the DYCO model to the DRI model of the economy. The model would consist of a set of equations based on historical relationships that would relate variables in the DYCO model to each other and to variables in the DRI model. It was to be constructed so that judgment could be exercised in determining the effects of changes in the economy on DYCO; there would be many parameters that could be varied by the user. Development of this model was the primary objective of DRI's model building efforts.

Programming for the model was to be performed by Suzanne Moot at DRI's Lexington, Massachusetts, office under the supervision of Fred Bamber. Peter Green was appointed liaison man from the Economic Analysis Department and five people from the department spent two weeks early in the program gathering data.

The relationship between DRI personnel and Economic Analysis Department personnel, which had been very close prior to the model, remained close through heavy use of the telephone. DRI personnel were given free access to the necessary company data.

The Accounting Identities Model was operational in early July, the Internal Pro Forma Model was operational on July 14, and the Econometric Model was available in preliminary version on August 5.

THE "ECONOMETRIC MODEL"

The Econometric Model was coupled directly to DRI's National Economic Model so that the user controlled it by varying some of the input parameters to the DRI model and some of the DYCO model parameters. The relationship between the two models is shown schematically in Figure 1.

The DYCO model made use of a number of variables from the DRI model as inputs. For example: A combination of economic activity in the chemical and rubber industries were used to forecast DYCO sales (an accurate prediction of DYCO sales was extremely critical because so many variables in the model depended upon it); the price index used to deflate the Gross National Product was used in forecasting DYCO direct costs; the DRI forecast of the interest rate of Moody's Aaa new issues was used in forecasting DYCO interest expenses (DYCO bonds were rated Aa); it was also used in forecasting receivables, since receivables tended to rise with interest rates; a measure of the tightness of the money supply was also used to help forecast receivables; and the DRI forecast of private non-farm inventories was used to forecast DYCO inventories.

About 20 variables affecting DYCO were under the user's control. These included capital spending (based on a periodic forecast by the corporate Engineering Division), cash and marketable securities, projected quarterly dividends, the effective tax rate (including a factor for the investment tax credit forecasted by the Engineering Department), planned long term debt, and government sales by the Explosives Division.

Compared to many corporate planning models, the DYCO model was a simple one, as evidenced by the small number of equations it contained. Forty equations produced the Income Statement, thirty-five more produced the Balance Sheet, twenty-five additional produced the Funds Flow, and forty produced the Financial Ratios. The majority of these equations were accounting identities and a large portion of the remainder were based on statistical analysis of historical relationships.

The output of the model was a simple forecast of the future with no statement of the uncertainty associated with the forecast. Sample output from a four-quarter forecast is shown in Exhibit 1; two-year forecasts were available if desired.

Figure 1
DYCO CHEMICAL CORPORATION (B)
Relationship between DRI and DYCO Models

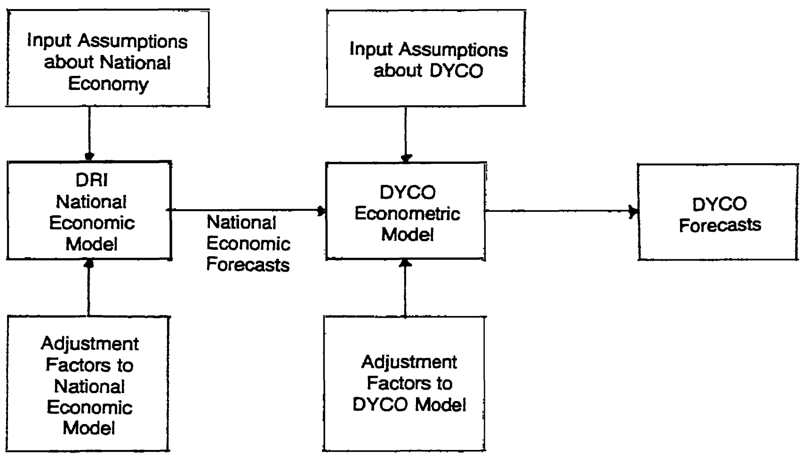


Exhibit 1

DYCO CHEMICAL CORPORATION (B)

Sample Output from the DYCO Model

DYCO INCORPORATED

INCOME STATEMENT

	72: 1	72: 2	72: 3	72: 4
NET SALES				
COMMERCIAL	117308.	127585.	130216.	129177.
GOVERNMENTAL	12797.	13738.	12997.	12840.
TOTAL	130105.	141323.	143213.	142017.
COST OF SALES				
COMMERCIAL	81209.	87681.	89611.	91110.
GOVERNMENTAL	7825.	8283.	7772.	7610.
TOTAL	89035.	95964.	97382.	98720.
GROSS PROFIT FROM SALES				
COMMERCIAL	36099.	39904.	40606.	38067.
GOVERNMENTAL	4972.	5455.	5225.	5230.
TOTAL	41071.	45359.	45831.	43297.
INDIRECT EXPENSE				
COMMERCIAL	23428.	24046.	24719.	25262.
GOVERNMENTAL	2708.	2708.	2693.	2713.
TOTAL	26136.	26754.	27413.	27974.
NET PROFIT FROM SALES				
COMMERCIAL	12671.	15857.	15886.	12805.
GOVERNMENTAL	2263.	2747.	2532.	2518.
TOTAL	14935.	18605.	18418.	15323.
INTEREST EXPENSE				
SHORT TERM	509.	583.	508.	504.
LONG TERM	1260.	1260.	1260.	1232.
TOTAL	1769.	1843.	1768.	1736.
MISC. PROFIT	388.	1483.	382.	504.
NET INCOME BEFORE TAXES	13553.	18245.	17033.	14091.
U.S. AND FOREIGN TAXES	6609.	8210.	7665.	6341.
NET INCOME AFTER TAXES	7454.	10035.	9368.	7750.
ACCRUED DIVIDENDS				
CLASS A & PREFERRED	7.	7.	6.	5.
COMMON	2987.	2990.	2995.	5397.
TOTAL	2994.	2997.	3001.	5402.
RETAINED EARNINGS	4460.	7038.	6368.	2348.

Exhibit 1
DYCO CHEMICAL CORPORATION (B) (Continued)

DYCO INCORPORATED .
EARNINGS REPORT

	72:1	72:2	72:3	72:4
AVE. SHARES OUTSTANDING	14933.250	14952.750	14972.250	14991.750
EARNINGS PER COMMON SHARE	0.498	0.670	0.626	0.517
DIVIDENDS PER COMMON SHARE	0.200	0.200	0.200	0.360

Exhibit 1

DYCO CHEMICAL CORPORATION (B) (Continued)

DYCO INCORPORATED
BALANCE SHEET

ASSETS

	72: 1	72: 2	72: 3	72: 4
CURRENT ASSETS				
CASH & MARKETABLE SECURITIES	14716.	14803.	15004.	15000.
ACCOUNTS RECEIVABLE	87585.	95033.	96826.	96557.
INVENTORIES	82164.	83020.	84007.	85121.
TOTAL CURRENT ASSETS	184465.	192856.	195838.	196678.
INDUS. REV. BONDS HELD BY TRUSTEES	2580.	2580.	2580.	2580.
FIXED ASSETS				
GROSS FIXED ASSETS	523748.	534154.	545116.	556032.
DEPRECIATION & AMORTIZATION	275294.	282466.	289758.	297259.
NET FIXED ASSETS	248454.	251688.	255358.	258773.
INVESTMENTS IN SUBSIDIARY AND ASSOCIATED COMPANIES	26356.	27556.	28756.	29956.
INVESTMENTS-OTHER	12659.	12496.	12461.	12360.
DEFERRED U.S. AND FOREIGN TAXES	7454.	7454.	7454.	7454.
DEFERRED CHARGES AND MISC. ASSETS	7984.	7969.	7950.	7950.
TOTAL ASSETS	489952.	502599.	510397.	515751.

LIABILITIES

	72: 1	72: 2	72: 3	72: 4
CURRENT LIABILITIES				
U.S. & FOR. INC. TAXES	18361.	15188.	18884.	16105.
NOTES PAYABLE	36393.	41673.	36253.	36000.
OTHER CURR. LIABILITIES	40066.	43184.	43822.	44424.
TOTAL CURR. LIABILITIES	94819.	100044.	98959.	96529.
LONG TERM DEBT	78634.	78634.	78634.	77038.
RESERVES				
INSURANCE	10090.	10266.	10442.	10612.
PENSION	24813.	24813.	24813.	23601.
OTHER	0.	0.	0.	0.
TOTAL	34903.	35079.	35255.	34213.
STOCKHOLDERS EQUITY	273503.	280871.	287570.	290248.
TOTAL LIABILITIES	489952.	502599.	510397.	515751.
BALANCING ITEM (TOTAL ASSETS - TOTAL LIABILITIES)	8093.	7970.	9979.	17724.

MEMO:

	72: 1	72: 2	72: 3	72: 4
AVERAGE TOTAL OPERATING ASSETS				
COMMERCIAL	646042.	659934.	675770.	688400.
GOVERNMENTAL	42382.	42917.	43308.	43429.
TOTAL	688424.	702852.	719078.	731829.

Exhibit 1

DYCO CHEMICAL CORPORATION (B) (Continued)

DYCO INCORPORATED
CASH FLOW FORECAST

SOURCE AND USE OF FUNDS

	72: 1	72: 2	72: 3	72: 4
SOURCE OF FUNDS				
NET INCOME AFTER TAXES	7454.	10035.	9368.	7750.
DEPRECIATION & AMORTIZATION	8003.	8141.	8286.	8521.
INSURANCE	155.	176.	176.	169.
DEF. U.S.& FOR. INCOME TAXES	0.	0.	0.	0.
SALE OF FIXED ASSETS	0.	0.	0.	0.
INDUST. REV. BONDS	0.	0.	0.	0.
LONG TERM DEBT	-1169.	0.	0.	-1596.
SALE OF CAPITAL STOCK	331.	331.	331.	331.
SUBTOTAL	14774.	18683.	18161.	15175.
CHANGE IN WORKING CAPITAL				
U.S. & FOR. INCOME TAXES	2993.	-3173.	3696.	-2779.
NOTES PAYABLE	778.	5280.	-5420.	-253.
OTHER CURRENT LIAB.	178.	3118.	638.	602.
TOTAL CURR. LIAB.	3949.	5225.	-1085.	-2430.
TOTAL SOURCE OF FUNDS	18722.	23908.	17075.	12745.
USE OF FUNDS				
CAPITAL EXPENDITURES	10200.	12600.	13200.	13200.
DIVIDENDS	2994.	2997.	3001.	5402.
INVESTMENT IN FOR. SUBS.	1200.	1200.	1200.	1200.
INVESTMENT-OTHER	-35.	-163.	-35.	-101.
CAPITAL STOCK REACQUIRED	0.	0.	0.	0.
DEF. CHARGES & MISC. ASSETS	500.	-15.	-19.	0.
OTHER USE OF FUNDS-NET	-1217.	-1225.	-1244.	-1264.
SUBTOTAL	13642.	15394.	16103.	18437.
CHANGE IN WORKING CAPITAL				
CASH AND MARKETABLE SECUR.	-262.	87.	201.	-4.
ACCOUNTS RECEIVABLE	1437.	7448.	1793.	-269.
INVENTORIES	670.	856.	988.	1114.
TOTAL CURRENT ASSETS	1845	8390.	2982.	840.
TOTAL USE OF FUNDS	18722.	23908.	17075.	12745.
BALANCING ITEM (SOURCES-USES)	3236.	123.	-2009.	-6533.

Exhibit 1

DYCO CHEMICAL CORPORATION (B) (Continued)

DYCO INCORPORATED
FINANCIAL RATIOS
PERCENT

	72: 1	72: 2	72: 3	72: 4
NET SALES (ANN. RATE)/AV. TOA				
COMMERCIAL	72.63	77.33	77.08	75.06
GOVERNMENTAL	120.77	128.04	120.04	118.26
TOTAL	75.60	80.43	79.66	77.62
GROSS PROFIT/NET SALES				
COMMERCIAL	30.77	31.28	31.18	29.47
GOVERNMENTAL	38.85	39.71	40.20	40.73
TOTAL	31.57	32.10	32.00	30.49
INDIRECT EXPENSE/NET SALES				
COMMERCIAL	19.97	18.85	18.98	19.56
GOVERNMENTAL	21.16	19.71	20.72	21.12
TOTAL	20.00	18.93	19.14	19.70
NET PROFIT FROM SALES/NET SALES				
COMMERCIAL	NA	NA	NA	NA
GOVERNMENTAL	17.68	20.00	19.48	19.61
TOTAL	11.48	13.16	12.86	10.79
NET PROFIT FROM SALES/GROSS PROFIT				
COMMERCIAL	35.10	39.74	39.12	33.64
GOVERNMENTAL	45.52	50.37	48.46	48.14
TOTAL	36.36	41.02	40.19	35.39
NET PROFIT FROM SALES(ANN. RATE)/AV. TOA				
COMMERCIAL	7.85	9.61	9.40	7.44
GOVERNMENTAL	21.36	25.61	23.39	23.19
TOTAL	8.68	10.59	10.25	8.38
NET INCOME B.T.(ANN. RATE)/EQUITY	19.82	25.98	23.69	19.42
NET INCOME A.T.(ANN. RATE)/EQUITY	10.90	14.29	13.03	10.68
NET INCOME A.T.(ANN. RATE)/AV. TOA	4.33	5.71	5.21	4.24
CASH & SECURITIES/TOTAL CURR. LIAB.	15.52	14.80	15.16	15.54
TOTAL CURR. ASSETS/TOTAL CURR. LIAB.	194.54	192.77	197.90	203.75
LONG-TERM DEBT/EQUITY	28.75	28.00	27.34	26.54

Work on the Model since August 5

The Economic Analysis Department took delivery of the model on August 5 at a meeting at which Suzanne Moot and Don McLagan, Vice President of DRI, gave a presentation at DYCO to Messrs. Schroeder and Green, the Corporate Treasurer, and two of the Assistant Treasurers.

Since August 5 Mr. Green, in consultation with Mr. Schroeder, had been refining and testing the model. Because he had been involved in its development, Mr. Green was satisfied that the basic equations were sound and that many parts of it were as refined as was practical. However, he felt that other parts could be improved.

To test the model he made forecasts with it and monitored the results. To differentiate between inaccuracies caused by the DRI model of the economy and those caused by the DYCO model, Mr. Green used a DRI-supplied set of data consisting of the actual economic results 8 quarters back as control input to the DYCO model. He then compared the forecasted DYCO results with the actual and isolated errors due to the DYCO model.

On the basis of the results of the DRI control data, forecasts made since August with DRI projections, and his knowledge of the structure of the model, he was able to improve the DYCO model through use of alternate input variables and through changes in the model itself.

One example was the improvement in accuracy of forecasting sales that resulted from forecasting government sales separately from non-government sales. Formerly the two had been forecasted as a single number which depended on the level of activity in the chemical and rubber industries. However, since governmental sales were to a single customer under a few large contracts, the Government Sales Department of the Explosives Division was able to provide quite accurate forecasts. The model now combined management forecasts of governmental sales and statistical forecasts of non-governmental sales for increased accuracy.

In another example, investment tax credits had been handled by adjusting the average effective tax rate; in a revision, the tax credits were modeled explicitly.

Yet another example was the way interest charges on corporate debt were handled. Formerly interest on the entire DYCO debt was derived from certain economic measures. After modificiation, the interest rate on corporate

Aaa bonds was used to predict the interest charges on a new Aa debt which were added to the actual charges on previous debt to get total interest charges.

Though he had many ideas about further work to improve the accuracy of the model, Mr. Green felt that two ideas were most promising. He observed that in time of economic expansion, indirect (GS&A) costs tended to lag sales growth and similarly during down turns, the cutback in these expenses generally began after the start of the down turn. He guessed that reflecting this lag in the model would remove about 10% of the remaining error in forecasting. There was also great potential in improving the sales forecast by forecasting sales of each individual product group separately and then combining them to obtain a total non-governmental sales figure. However, he felt that this second refinement might require several months of data analysis to implement.

Mr. Green thought of the accuracy of the model in terms of forecasting earnings per share because of the great interest of DYCO management in those numbers. He told the casewriter, "We've had a rather short experience with using the model for forecasts, so we don't have too many actuals against which to test our forecasts. But based on our short experience, my knowledge of what's in the model, and my best judgment, I'd guess we could hit annual earnings per share one year ahead to within ± 10%. In my judgment the best we could ever hope for is ± 5% given the current state of the art."

In his limited experience testing the model Mr. Green had discovered that the DYCO model had to be managed through the use of adjustment factors just as DRI's model did. For example, he found that the third quarter 1971 sales forecast had exceeded actual and upon review of the actual DYCO figures he noticed that international sales were off sharply. He then recalled the dock strike in that time period and concluded that he could have and should have corrected for the strike with an adjustment factor. Likewise, soon after the dock strike ended there would be pent up demand so an adjustment factor of the opposite sign would be needed temporarily to reflect this. Further, he decided that the lag in indirect expenses, mentioned above, could be handled temporarily through the use of adjustment factors or by using the budgeted figure.

Mr. Green estimated that about 6 man-months of effort by Department personnel had gone into the model. About

half of this occurred before the delivery of the model by DRI, including two man-months of data collection and one man-month of support work and of conferences with DRI. Since August Mr. Green had put in about two months refining the model and another half month taking trial runs. He estimated that about 40% of his time during 1972 would be spent working with and developing the model.

The DRI service during 1972 cost $25,000, not including model development, but including rental of the computer terminal and computer charges. The DYCO model was just one of many uses made of the DRI service. Mr. Kirkpatrick did not need the Treasurer's approval before starting a new project such as the modelling effort provided he didn't exceed his budget. However, he did, as a matter of courtesy, keep the Treasurer informed of all projects of any size.

Problems in Developing the Model

A number of problems were encountered in developing the model. Perhaps the most time consuming was obtaining reliable and consistent historical data, since much of the historical accounting data had to be adjusted to account for intercompany sales, mergers, and acquisitions. (Among the larger acquisitions were a rubber belt company in 1956 having $13 million sales, a $25 million sales paint company in 1960 and a $22 million sales latex foam manufacturer in 1964.) These acquisitions were dealt with by generating pro forma financial statements for a half dozen of the largest acquisitions before they became affiliated with DYCO and then making adjustments in the acquired companies' accounting data to make it compatible with DYCO's accounting conventions.

A second problem was deciding on which of the 400 or more variables projected by the DRI model to use as a basis for making forecasts of various variables in the DYCO model. A good example was the forecasting of DYCO sales. Two kinds of variables from the DRI model could be helpful: projections of broad economic indicators such as GNP and Industrial Production and projections of the level of activities of the 81 different industry groups. Attempts to forecast sales based on the broad economic indicators were disappointing. Attention was then turned to the list of industry groups, a number of which could be arbitrarily eliminated (such as leather, iron and steel). Others were thought to be related to DYCO sales,

such as the lumber industry, but less so than some others. The list was narrowed to the chemical, paper, rubber, food and kindred products, textiles, and motor vehicles and parts industries. After considerable statistical analysis, only the chemical and rubber industries were actually used.

Another problem arose when reconciling output from the model with the company's accounting reports. Mr. Schroeder decided that output from the model would be presented in a format compatible with reports currently in use to facilitate communication with top management. When the results of the Accounting Identities Model failed to match the historical funds flow reports exactly, a meeting was scheduled with the Manager of Accounting to reconcile the differences. "His comments at the meeting," Mr. Schroeder said, "indicated the maze of detailed accounting procedures required to satisfy the Accounting Principles Board, and we decided not to incorporate them in the model. This meant that while the format of the model and the currently used reports were identical, the results might differ by 5%."

USING THE MODEL

Running the DYCO Econometric model used about $30 of computer time and an hour of Mr. Green's time at the time-sharing terminal. Once the first run was set up additional runs could be made in 10 minutes at a cost of about $20 each.

These figures assumed that the base case forecasts from the DRI model were used; if a new run of the DRI model was made the cost increased by $10. Only rarely were changes made in the assumptions to the DRI model, since the modelers preferred not to outguess the DRI economic forecasts. Instead they concentrated on the assumptions for the DYCO model which were determined in face-to-face and telephone conferences with DYCO managers and by using their own judgment.

THE FUTURE OF THE MODEL

After Messrs. Kirkpatrick, Schroeder and Green had discussed modifications to the DYCO planning model at their January meeting, their discussion shifted to uses of the model and to when and how it should be introduced.

Mr. Kirkpatrick emphasized the need for caution in introducing the model. "I doubt that the twelfth floor (the location of top management offices) knows about our model," he reminded the others. "They have had bad experiences in the past when untested tools were sold prematurely. We all know what happened when 'leading indicators' were touted as a forecasting device. The indicators fit past data well but were not sufficiently reliable as a forecasting tool.

"And we also know how complicated techniques can turn off top management. The risk analysis program developed by the Operations Research Department to analyze new investment projects is fantastically comprehensive for analyzing projects but top management was slow to accept it. It's so complicated that it takes a long time even to set up a project analysis on the computer."

"But our model isn't all that complicated," interjected Mr. Green. "And we were able to do a pretty good job...and a quick one too...in forecasting the impact of Nixon's new economic policy. I'm willing to bet that there isn't a better way around to study the implications of these new policies. I think we ought to consider introducing the model soon."

"We've got top management's ear and confidence and our credibility with them is our most precious asset," Mr. Kirkpatrick replied, "and everyone calls here for information when they need it. We can't afford to risk our reputation on a possible bad experience with this model. Don't get me wrong, Peter; I'm as enthusiastic about using this new tool as you are. But, there's a limit to the rate of change any organization can stand and using a model for forecasting is quite an innovation."

"Maybe what we should do is to begin to use the results of the model in conjunction with our current forecasting approach, and keep quiet about the role of the model," suggested Mr. Schroeder. "Then as we gain experience, we can tell top management about the model and begin to educate them in its use and interpretation."

"Regardless of when we do it we're going to have to educate top management in the use of the model at some point so that they can use the results," said Mr. Kirkpatrick. "I'm sure that due to our good relationships we can get as much of their time as we need to bring them up to date when we are ready.

"Getting to your earlier point, I have my doubts that

the model will ever supplant our current forecasting approach, but I can see it playing an increasing role in producing our forecasts. I think it will help the one year forecast, but it will be even more helpful in forecasting the second year into the future. That's where our division management finds prediction difficult; they don't do badly at all on one-year forecasts. Another role it can play is to give us a quick turnaround in updating our forecasts when conditions suddenly change.

"I'm concerned about a conversation I had with the Treasurer yesterday," Mr. Kirkpatrick continued. "He was asking how the model was coming along and though he didn't say so in so many words, I could tell he was hoping we would be putting it to use soon. I'd hate to be pressured into a move that we'd later regret."

The men then turned their attention to uses for the model and things they might do in the future. They had previously agreed that one of the main purposes of the model would be to provide a "top down" bench mark for the total company forecast so that they would be in a position to constructively criticize the forecasts presented by the individual divisions. They also hoped to use the model to give management an idea of the ranges of things that could occur within the two-year period the model forecasted. They discussed the possibility of modifications to the model so that DRI's ten year economic forecasts could be coupled with it to produce a longer range forecast. This would require the assumption that certain key ratios remained constant within the company during the ten year forecast, an assumption with which the men felt uneasy.

Looking further downstream they speculated on building similar models on a divisional basis and coupling these to the corporate model. Mr. Kirkpatrick also suggested the possibility of introducing probabilities for some of the uncertainties so that one could get a feel for the chances of various outcomes actually occurring.

Finally Mr. Kirkpatrick stood up and said, "Well, gentlemen, let's knock off for today. It's all well and good to speculate, but our primary concern right now is getting something we have a lot of faith in."

Southwest Lumber Company

In the late fall of 1976 Mr. Bill Dawson, Marketing Vice President of the Southwest Lumber Company, a California chain of home improvement centers headquartered in San Diego, was reviewing staff reports recommending the implementation of an expanded Retail Management Information System (RMIS).

Southwest Lumber had experienced rapid sales growth over the past five years, with irregular profit results. Mr. Dawson believed that systems development could be considerably improved and that such improvement was necessary if Southwest was to achieve the corporate 20% pretax return on investment goal. Mr. Dawson had a particular interest in measuring product group performance in Southwest's large home centers.

Although the need to refine sales reporting and improve inventory management was recognized throughout the company there was considerable disagreement concerning the usefulness of the proposed RMIS in achieving that objective. Mr. Dawson believed that it was necessary to determine specific objectives for the RMIS, and because the resulting information could be useful to other parts of the company to determine to whom and at what intervals reports should be issued, and what actions managers would be responsible for taking on the basis of the reports.

The Do-It-Yourself Market

The do-it-yourself (D-I-Y) trend had recently boomed in the United States. In 1974, the domestic home improvement market was estimated to be approximately $25 billion. At that time industry experts expected the market to grow on the order of 10% per year in real terms over the foreseeable future. There were a number of factors positively influencing D-I-Y market growth:

1 a shortage of homes and rising home prices encouraging the renovation and expansion of existing houses.

2 better and more aggressive marketing by retailers and manufacturers producing a growing awareness among homeowners that by undertaking D-I-Y projects they can enjoy substantial savings.

3 rapid and sizeable wage increases for tradesmen forcing homeowners into doing more of their own repairs, maintenance and home improvements.

4 growing leisure time and rising discretionary income stimulating interest in D-I-Y products.

Until the early 1970s the retail D-I-Y market had been highly fragmented; shared by a large number of independent hardware stores, lumber yards and only a few chains. These companies and others moved quickly to change from chains of lumber yards to broader retailing units known as home improvement centers (Exhibit 1 lists selected major D-I-Y retailers).

The Home Improvement Center Concept

The home improvement center concept is based on providing total service to the D-I-Y market. Hardware Age described home centers as "a specialty store the way a men's clothing boutique is--a special kind of store for a particular kind of person. In this case it is the do it yourselfer." In a typical home center, "the novice can find everything for the home except furniture. And he can find it in 30 varieties, in five colors and six price ranges. And he'll find qualified people to serve him. This kind of service has not been available, except at the neighborhood hardware store. But the local hardwareman could not offer the selection or back up inventory..."

The home improvement center concept had developed along two lines with the construction of new stores and the modernization of existing retail units, particularly lumber yards. The new stores, usually referred to as home centers, were generally targeted toward the do-it-yourselfer and carried a wide variety of merchandise with heavy emphasis on hard goods. The modernized lumber yards, referred to as building centers, typically continued to sell primarily to contractors and builders.

Many firms, including Southwest, had developed a cash and carry lumber business aimed at the more knowledgeable

customer. This development grew from the belief of many hardgoods merchants that some home centers were not distinguishing their knowledgeable customers from their novices. "The do-it-yourselfer," stated one industry source, "requires service, consultation and information. He wants to know what is available and how to use it. The expert already knows what he wants."

Southwest Lumber Company

Southwest Lumber Company was founded in San Diego in 1926 to sell lumber and building materials to contractors and consumers. At the time Southwest Lumber was formed its president, Mr. Albert Le Bouton, believed that the population growth of the western states coupled with the relatively small number of home builders and the relatively low incomes of new settlers represented an opportunity for the development of a home building supply retail chain.

Mr. Le Bouton's strategy had been to expand throughout the Pacific western states. Only in the last decade had the firm expanded into adjoining eastern states. Each store manager stocked an assortment of lumber and building supplies compatible with the needs of the customers in the store trading area. A basic assortment consisted of plywood sheets, siding, framing lumber such as two by fours, windows and window frames, roofing shingles and small hand tools.

Southwest had developed a strong consumer franchise in rural areas, but had never done well in the more highly competitive metropolitan markets. This failure had been attributed to a lack of metropolitan hardgoods expertise, almost completely decentralized buying and merchandising, and stores of inadequate size for a metropolitan market.

In the spring of 1972 Southwest Lumber was purchased by Pedley Foods, Inc. Pedley, a large and well known canner of fruits and vegetables, also produced and marketed construction equipment in its Commercial Products Division, and owned a major car rental franchise in the Southwestern states.

For Pedley, the purchase of Southwest marked the formation of the Retail Products Division (RPD). Later acquisitions included in the RPD were Jordan Hardware, Basic Lumber (Retail Division), Inc. and Villon Lumber Distributors, Inc. 1972 sales for the RPD totaled $118 million (Exhibit 2 provides sales figures for the RPD from 1972-1976).

Exhibit 1
SOUTHWEST LUMBER COMPANY
Selected Major Domestic DIY Retailers

Name	Number of outlets	Average sq. ft.	Number projected by 1980
Astra	160	8,000 to 10,000	200
Barder	253	10,000 to 55,000. 16 over 20,000; 30 of 10,000 to 20,000; 9 below 10,000	5 to 7 stores a year planned
BLD, Inc.	75	8,000	50
Crest	32	55,000 range. Crestmart from 1,000 to 11,000	Future centers will be limited to 30,000 sq. ft.
Discount Dan's	15	5,000	---
Homeman Craftsman	6	20,000 to 30,000	---
Hulm Hardware	56	14,000	Approx. 10 new outlets each year

Astra believes their biggest asset is the promotional punch behind the "A" frame houses. Stores receive a promotional kit every two months with newspaper ads, finished artwork and layouts, radio and TV scripts and material for pop and in-store display.

"We are working on long-range plans catering to DIY trade, as we believe this trend will continue into the foreseeable future," Barder marketing manager Jim Macey said. "We are tending to emphasize lumber and building materials somewhat more than we have over the last few years."

BLD specializes in heavy construction materials but renovation centers in each outlet stress decorator products and hardware.

Home centers will continue to appeal to the DIY consumer, with a broad range of product mix, coupled with ad campaigns, "sharp" pricing and attractive locations with plenty of parking. Crestmart stresses knowledgeable sales staff, a good wood supply and well-planned ad campaigns, of which flyers are the cornerstone.

Discount Dan's also caters directly to contractors (over 3,000) with contract servicing, etc. Dan Sullivan says: "We have an active advertising and merchandising approach with empahsis on staff and service. We have a tremendous emphasis on staff capabilities."

Homeman is consolidating its position and expects that 1976 is going to be "price year," in their areas.

The feeling is that the outlook for home centers has never been better. Most of Holm's home centers are free-standing in areas with high density, single-family dwellings. About five are adjacent to plazas.

Exhibit 1
SOUTHWEST LUMBER COMPANY
Selected Major Domestic DIY Retailers

Name	Number of outlets	Average sq. ft.	Number projection by 1980
Johnson	62	6 are 20,000; rest are 12-15,000	---
Luck Hardware	10	10,000 to 15,000	5 centers planned for 1976
Peters	16	20,000 to 90,000	---
Revelation	15	12,000. 2 are 25,000; 5 are 15,000; 8 are 10-15,000	Renovation program underway
Roman	185	8,000 to 10,000	25 each year
Valiant	14	5,000 to 12,000	3 each year

Norm Samson, building supplies merchandise manager, predicts home center sizes will drop to 30,000 sq. ft. maximum as a result of rising overheads. He feels confident the DIY trade will remain strong.

Gordon Price, vice president and asst. general manager, believes home centers are the "coming thing." He also noted a buoyant economy in the West. In Arizona labor is hard to get and rates are very high, making home centers a necessity, he said.

Peters reports to be on the verge of a breakthrough in furniture outlets. "However, we do not intend to forget the consumer's current needs in renovation materials," says David Rogers, comptroller.

Revelation has a major renovation program underway. Smaller home centers than their original 21,000 sq. ft. center are predicted.

Everything involved in interior decorating is promoted at Roman. "Prefabricated kitchen cabinets and ceramic tiles for bathrooms are by far the most popular accessories right now," says George Sanders, manager, construction materials division.

David Nelson, vice president marketing, believes Valiant responds very adequately to customer demand at the present time. "What is popular here is that the customer finds all the products necessary to meet his renovation needs from A to Z, from basement to attic."

Exhibit 2

SOUTHWEST LUMBER COMPANY

Sales Trends for Retail Product Group

Year	Sales (M)	% increase	% of consolidated sales
1972	$ 33.2*	-	9%
1973	131.2	12%**	25
1974	174.6	33	28
1975	211.8	21	29
1976	232.2	9	28

*Annualized Sales $118,000,000

**Based on 1972 annualized figure

"When Pedley's bought Southwest and Jordan they had no intention of staying in either the lumber or the hardware business," said John Kelsoe, vice president-administration for Southwest. "They intended to combine the two into the home improvement center concept. Pedley's was in search of other businesses that would contribute to the overall profitability of the company and had been impressed with the growth of the hardgoods market, particularly through home centers."

Initially, both Southwest and Jordan contributed to both sales and earnings growth for Pedley's. Net earnings of Southwest Lumber for the three months ending March 31, 1972 were 12% above the same period a year earlier.

In 1973 several of Southwest's existing stores were refurbished, the first large (50,000 total sq. ft.) Southwest Home Center was opened, one slightly smaller center opened, and a number of sites were acquired for expansion in the coming year. Pedley's 1973 annual report referring to Southwest stated, "We believe this to be a sound market segment with good growth prospects and we plan to increase our investment in this activity significantly."

In 1974, four major home centers were opened, five medium-sized Southwest stores were modernized, and nine small lumber yards (primarily located in rural areas) were closed. From the time of acquisition until 1974, the number of Southwest stores had been reduced from 163 to 136 but total square footage had increased by almost 30%.

Southwest management was very pleased with consumer acceptance of the home center concept and the products offered in the Southwest Home Centers. The merchandise assortment of home centers had expanded considerably in the past two years in an attempt to attract a somewhat higher educated, higher income, homeowning consumer.

Merchandising had become more centralized, with about 85% of the assortment prescribed and the remainder discretionary with store managers. New operating goals had been established. As one manager put it, "We're targeting for 4-1/2 inventory turns. We're also targeting for an overall margin of 34% and $110 in sales per square foot."

Advertising had become an important tool for Southwest. The company ran newspaper ads weekly, promoting specific products and ran image advertising on television. The advertising to sales ratio for the industry was estimated at about 2% overall and 3% in major metropolitan areas. It was generally believed that Southwest expenditures were

close to the industry average. Advertising and promotion campaigns originated with central management, but varied somewhat from region to region to suit market and climate conditions.

As home centers began to spread geographically, and merchandising became centralized, Southwest had developed a new distribution system. Until this time stores relied on three small warehouses that had been part of the Jordan chain, and on direct shipments from manufacturers. In 1973 another Pedley subsidiary, Johnson, Inc., had built a large distribution center for bulk storage and food distribution. Southwest decided to utilize this center to facilitate centralization of wholesale inventories. As one manager put it, "Southwest doesn't have to worry about the warehousing end of the business. We simply pay a ten percent markup to Johnson, and devote more time to our top priorities--merchandising, selling and store location. There are just too many problems with supplier dependability and service levels to each store when you use direct shipments. The new distribution center will rely heavily on sophisticated computerization. Incoming orders will be put on cassette tapes and merged with information in the computer to produce order picking sheets."

By the end of 1974 Southwest management warehoused about 30% of merchandise and expected that percentage to increase to 70 or 80 percent in the next few years. Management believed the percentage of merchandise shipped from the warehouse would still vary considerably by merchandise line.

Southwest sales in the larger stores were well ahead of anticipated targets by the end of 1974. However, net earnings declined. The earnings decline reflected initial expenses of growth including pre-opening costs related to new stores. These costs exceeded by $1.25 million the level of such expenses absorbed in 1973.

In 1975, five additional large Southwest Home Centers were opened, ten stores were expanded and twelve existing stores closed. Despite sales gains the RPD experienced a sharp decline in earnings resulting in a loss for the year. This loss was attributed to three principal factors: the adverse effect on margins caused by a sharp decline in lumber prices, costs associated with the startup of the computerized central distribution system, and higher than anticipated store pre-opening costs totaling $9.2 million. Management, convinced of the soundness of the home center

concept, thought that its job was now to focus on strengthening and improving support services, distribution, merchandising, and management information systems.

In 1976 capital spending was reduced to $2.9 million, eight stores were closed and changes in merchandising strategy introduced. Consumer and store research studies led to a change in product policy emphasizing more basic D-I-Y merchandise, changes in store layout and a more aggressive price policy. Although a pretax profit of $12 million was realized, profits for Southwest continued below acceptable levels.

Although a pretax rate of return of 11% on net operating assets was projected for fiscal 1977, the achievement of a minimum 20% pretax return remained the prime consideration in Southwest's short- and long-range planning.

As 1976 came to a close management believed the following key issues had to be addressed if the company was to continue progress towards the 20% return objective:

1 Sales must continue to increase faster than the rate of inflation at existing home and building centers and the current unfavorable sales trends in some units must be reversed.

2 The company must attract and develop the type of people required to achieve sales, margin, expense and turnover objectives, and to support the significant expansion program planned for the next five years.

3 The implementation of the competitive pricing aspects of the merchandise policy must be accompanied by aggressive plans and programs to improve gross margin performance.

4 Understanding of the home center and building center concepts must become more widespread within the RPD organization, and the concepts themselves must be constantly reviewed and improved in line with changing market opportunities and as results dictate.

5 Increased productivity through more consistent control of expenses and working capital across the organization must be achieved.

Exhibit 3 provides selected statistics for a 1976 sample of Home Centers. Exhibit 4 provides a quarterly contribution statement for a typical Home Center.

Exhibit 3

SOUTHWEST LUMBER COMPANY

Selected Operating Statistics by Department for Twelve Large Home Centers

Store	Hardware	%	LBM*	%	Housewares	%	Seasonals	%	DPW**	%	Flooring	%	Plumbing	%	Electrical	%	Store total
							Sales ($000) (one selected month)										
1	31	13%	62	26%	14	6%	8	3%	40	17%	23	10%	34	14%	24	10%	236
2	20	12	43	26	9	5	9	5	29	17	14	8	26	16	17	10	167
3	47	13	89	24	14	4	11	3	72	19	32	9	72	19	36	10	360
4	34	12	63	23	19	7	8	3	61	22	32	12	39	14	18	7	274
5	33	13	63	24	19	7	15	6	51	20	23	9	34	13	20	8	258
6	14	13	43	41	5	5	3	3	19	18	6	6	10	9	6	6	106
7	20	13	49	33	6	4	5	3	32	21	6	4	17	11	15	10	150
8	28	11	77	32	17	7	7	3	57	23	16	7	25	10	17	7	244
9	13	13	29	28	5	5	5	5	22	21	8	8	11	11	10	10	103
10	30	13	69	30	10	4	6	3	47	20	25	11	29	13	15	7	231
11	35	14	64	26	19	8	6	2	63	26	14	6	31	13	15	6	247
12	17	11	71	47	1	1	2	1	34	23	6	4	12	8	7	5	150

Store	Hardware	LBM*	Housewares	Seasonals	DPW**	Flooring	Plumbing	Electrical	Weighted average: all departments
				Inventory turnover (12 months)					
1	1.7	4.5	2.1	1.1	2.7	3.0	2.0	1.7	2.8
2	1.7	5.6	2.3	2.5	2.5	2.4	2.9	2.6	3.2
3	1.9	4.8	1.6	2.2	2.9	3.0	4.4	2.4	3.4
4	2.6	6.3	2.5	2.4	3.4	5.0	3.0	2.3	3.9
5	1.7	4.6	1.7	1.7	1.6	2.3	1.9	1.9	2.5
6	1.3	5.9	1.1	2.0	2.0	1.4	2.1	1.2	3.4
7	1.4	4.3	1.1	1.3	1.9	1.0	1.6	1.6	2.5
8	1.9	9.1	1.3	2.3	2.1	2.2	2.4	1.3	4.3
9	1.4	4.5	1.2	1.8	2.0	1.5	1.9	1.4	2.5
10	1.5	3.4	1.3	1.3	2.1	2.6	2.1	1.2	2.4
11	2.3	5.2	2.1	5.0	3.0	2.7	4.0	1.8	3.7
12	1.6	3.9	N/A	1.8	3.0	2.7	1.8	1.1	3.0

*Lumber and Building Materials
**Decorator, Paint and Wallpaper.

Exhibit 3

SOUTHWEST LUMBER COMPANY

Selected Operating Statistics by Department for Twelve Large Home Centers (Continued)

Store	Hardware	LBM*	Housewares	Seasonals	DPW**	Flooring	Plumbing	Electrical	Weighted average: all departments
			Sales/square foot (12 months)						
1	128	52	42	52	96	84	104	113	85
2	134	82	45	105	86	67	97	101	91
3	130	102	34	91	132	105	109	180	113
4	156	111	72	76	127	124	99	109	116
5	107	59	43	104	71	45	68	69	58
6	99	151	29	100	92	35	67	40	106
7	76	60	48	67	67	31	46	41	58
8	95	85	41	87	84	50	61	48	65
9	92	68	35	119	83	37	81	57	56
10	105	189	29	86	71	62	59	49	106
11	138	77	42	114	122	57	98	71	97
12	190	N/A	19	123	155	141	90	80	119

Store	Hard-ware	LBM*	House-wares	Sea-sonals	DPW**	Floor-ing	Plumb-ing	Elec-trical	Weighted average: all departments
				Gross margin/sq. ft. (12 months)					
1	$51	$16	$16	$13	$37	$19	$39	$47	$30
2	51	21	15	20	32	19	32	35	29
3	52	34	13	23	51	35	41	73	44
4	65	35	28	19	52	41	36	44	43
5	44	19	16	21	30	16	25	30	26
6	42	49	10	16	38	12	23	15	37
7	33	20	20	12	29	9	16	41	24
8	40	28	16	20	36	18	21	21	28
9	39	21	13	29	34	12	28	22	26
10	42	64	11	19	29	22	20	18	38
11	55	25	15	28	50	20	35	32	37
12	79	N/A	7	19	65	49	33	38	45

*Lumber and Building Materials
**Decorator, Paint and Wallpaper

Exhibit 3

SOUTHWEST LUMBER COMPANY

Selected Operating Statistics by Department for Twelve Large Home Centers (Continued)

Store	Hard-ware	LBM*	House-wares	Sea-sonals	DPW**	Floor-ing	Plumb-ing	Elec-trical	Weighted average: all departments
				Gross margin per dollar inventory (12 months)					
1	1.1	2.0	1.3	.4	1.8	1.3	1.2	1.3	1.5
2	1.2	2.1	1.3	.7	1.6	1.1	1.6	1.6	1.6
3	1.4	2.5	1.0	.8	2.0	1.5	2.7	1.7	2.0
4	1.9	3.1	1.6	.9	2.5	2.6	1.8	1.7	2.3
5	1.3	2.2	1.0	.5	1.2	1.6	1.2	1.5	1.5
6	1.0	2.9	.6	.5	1.5	.8	1.2	.8	1.8
7	1.1	2.2	.8	.3	1.5	.5	.9	1.0	1.4
8	1.5	4.7	.9	.8	1.7	1.3	1.3	1.1	2.4
9	1.1	2.2	.8	.7	1.6	.8	1.1	1.0	1.5
10	1.1	N/A	.8	.4	1.6	1.4	1.1	.9	1.6
11	1.6	2.5	1.3	1.8	2.2	1.5	2.3	1.5	2.0
12	1.2	1.9	N/A	.4	2.2	1.4	1.1	.9	1.8

*Lumber and Building Materials

**Decorator, Paint and Wallpaper

Exhibit 4

SOUTHWEST LUMBER COMPANY

Contribution Statement: Typical Home Improvement Center

(First Quarter 1976)

Sales	
Regular	$492,785
Sales deductions	
-Discounts	7
-Returns/Allowances	11,713
-Total sales deductions	11,720
Contract Sales	6,241
Net Sales	$487,306
Gross Margins	
Regular	$157,789
Contract	1,061
Total Unadjusted Margin	$158,850
Adjustment to Margins	
Manufacturer rebates	59
Total Margin Adjustments	59
TOTAL GROSS MARGIN	$158,909
Controllable Expenses	
Salaries	
-Regular	$ 29,796
-Parttime	8,990
-Allocated	200
Total salaries	38,986
Employee benefits	3,149
Total Salaries and Benefits	$ 42,135
Other Controllable Expenses	
(Supplies, delivery expense, utilities, etc.)	$ 14,266
Interest on controllable investment	10,387
Additional distribution charges	2,060
Total Other Controllable Expenses	$ 26,713
Total Controllable Expenses	$ 68,848
Other Store Expenses	
Advertising/Media	$ 8,333
(Rent, insurance, lease charges)	23,881
Total Other Store Expenses	$ 32,214
OPERATING PROFIT	$ 57,847

Strategy and Organization

Southwest's strategy of segmenting the market according to the experience of consumers in conducting D-I-Y projects, and the recent geographic expansion, had brought about organizational changes.

Exhibit 5 provides a partial organization chart.

In order to accommodate operating differences between home centers and building centers separate divisions were created for each. There was also a General Manager for the Eastern Division. The Eastern Division consisted of the states of Nevada and Arizona, each of which contained six home centers. In addition, there was a Manager for Lumber and building Materials (LBM). Virtually none of the Lumber and Building Materials products were shipped to stores from the central warehouse. The LBM Manager was responsible for coordinating the buying and selling functions for these products. At the head office, the LBM buying function consisted primarily of negotiating arrangements with major vendors which were then administered by the LBM department.

Apart from the LBM department, one of the characteristics of Southwest's organizational structure was the separation of certain head office responsibilities between the Merchandising and Marketing functions.

Merchandising was responsible for purchasing all merchandise shipped to stores through the central warehouse, and for developing lists of approved vendors from whom store managers could purchase merchandise not available through the central warehouse. Merchandising was also responsible for establishing initial prices on all centrally-procured merchandise.

The buying function was supervised by Group Merchandise Managers. Southwest had six Group Merchandise Managers, each responsible for purchasing merchandise in one, two or three departments (Exhibit 6 provides a departmental breakdown). Most Group Merchandise Managers were assisted by one or two Buyers or Assistant Buyers. These individuals' principal responsibility was to repurchase stocks of merchandise for the central warehouse. Buyers and Group Merchandise Managers received weekly reports on product shipments from the warehouse and varied purchases according to the volume of warehouse shipments.

Marketing was responsible for Advertising Production,

Exhibit 5
SOUTHWEST LUMBER COMPANY
Organizational Charts
(Partial)

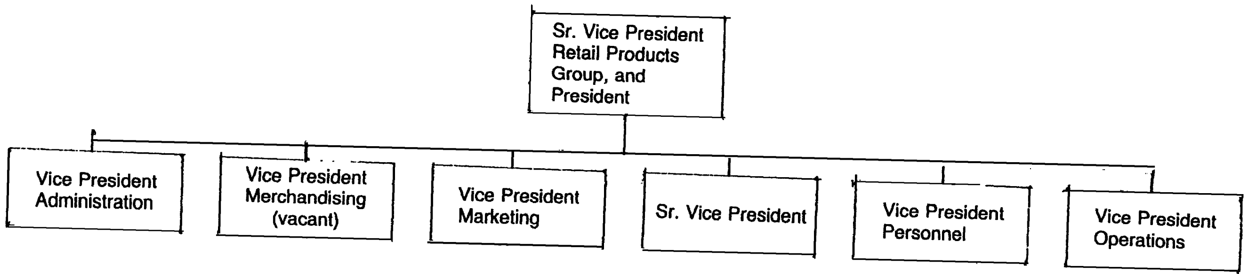


Exhibit 5
SOUTHWEST LUMBER COMPANY
Organizational Charts (Partial) (Continued)

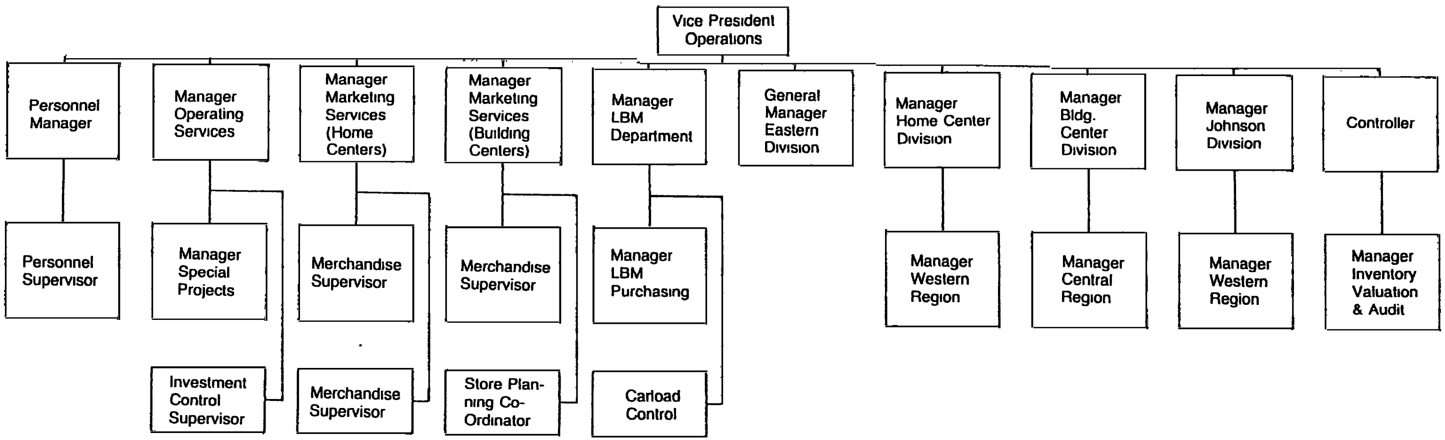


Exhibit 5

SOUTHWEST LUMBER COMPANY

Organizational Charts (Partial) (Continued)

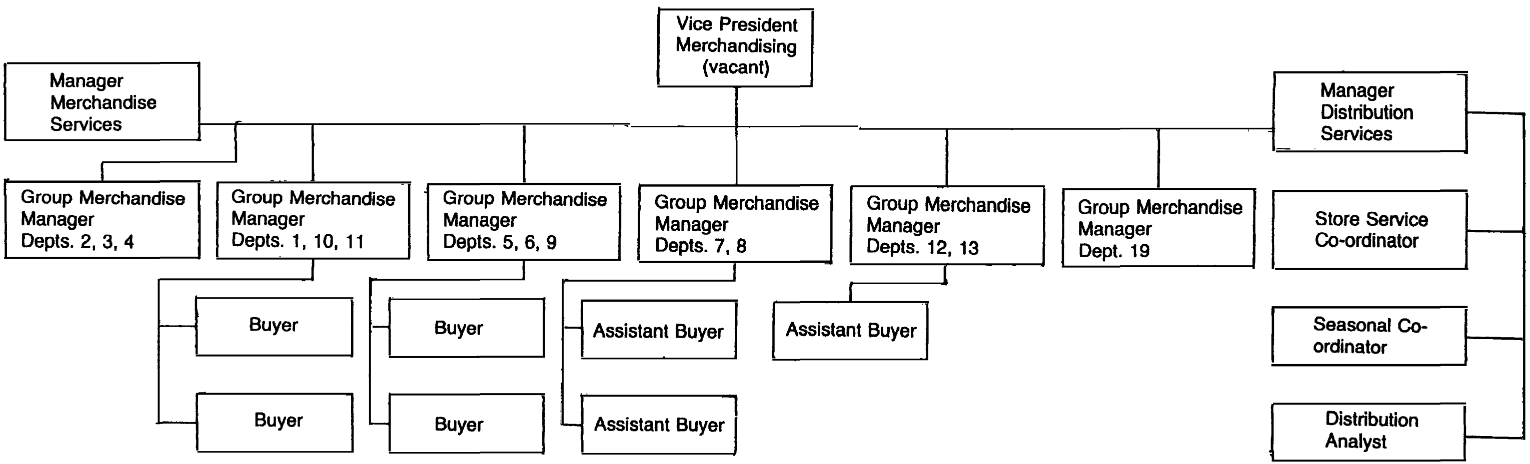


Exhibit 5

SOUTHWEST LUMBER COMPANY

Organizational Charts (Partial) (Continued)

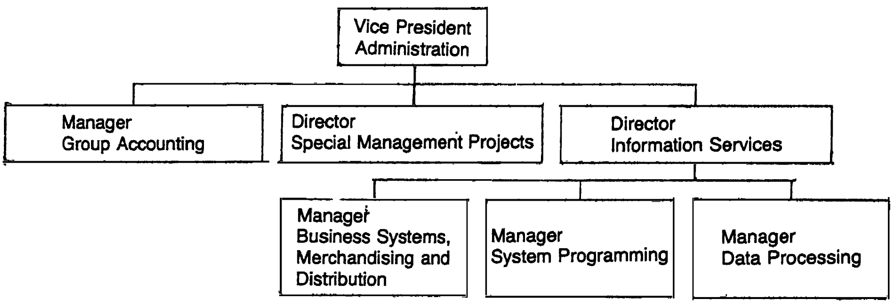


Exhibit 5
SOUTHWEST LUMBER COMPANY
Organizational Charts (Partial) (Continued)

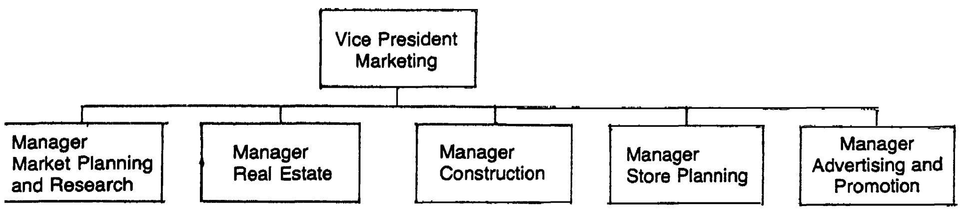


Exhibit 6

SOUTHWEST LUMBER COMPANY

Hard totals	Department no.	Department
1	DEPT. 1, 10, 11	Hardware
2	" 2, 3, 4	Lumber & Building Materials
3	" 12, 13	Housewares
4	" 19	Seasonals
5	" 5, 9	Decorator
6	" 6	Flooring
7	" 7	Plumbing
8	" 8	Electrical

Market Planning and Research, Store Planning, Real Estate and Construction.

Marketing Service Managers developed overall advertising budgets, determined which products were to be advertised, and were responsible for the timing and execution of all advertising. Advertising Production was responsible for the development of actual advertising. The Marketing Service managers were part of the store operations pyramid (see Exhibit 5, page 196).

Markdown responsibility was divided between Marketing Service managers and store managers. The former initiated markdowns on advertised merchandise, the latter were responsible for markdowns of slow selling and damaged merchandise.

The Market Planning and Research Manager developed short- and long-run marketing plans and maintained ongoing analyses of customers, competitors and the trade.

The Real Estate Department's principal responsibility was for finding, evaluating and acquiring leases on land for new store construction, which was supervised by the Construction department.

Store Planning was responsible for the layout of new stores including space allocations by department and product group.

Commenting on this separation of responsibilities, Bill Dawson said that his job had primarily a long range strategic focus as evidenced by his concern with store size and layout. "We develop the skeleton and Merchandising puts the flesh on the bones." Mr. Dawson also believed that Advertising Production was a relatively minor part of the total advertising program and that this activity was essentially an Operations responsibility.

Formally, coordination between Operations, Merchandising and Marketing occurred at the Vice President level. In reality, however, much informal coordination took place between these groups. For example, Merchandising worked with the Home Center Division in developing merchandise assortments, and Marketing consulted with both of these groups in the refinement of store plans.

The Development of a Retail Management Information System

Bill Dawson saw an efficient RMIS as critical to the achievement of Southwest goals. He believed that a well designed system providing systematic information would

facilitate the development of model store plans and product group allocations, which were a prime concern of his Store Planning department. Mr. Dawson also believed that this information could be useful to Merchandising in the development of model store assortments. He thought that Operations could then adjust the model store assortments to meet local demand conditions and thus increase inventory turnover.

Although the current RMIS system had undergone frequent changes as a result of the growth of the home center concept and Southwest's position in the market, Mr. Dawson believed that growth would proceed in a more orderly manner in the future and that any new RMIS would have to remain in effect for some time.

The Current System

The RMIS currently utilized by management consisted of three separate components:

1 Sales--obtained monthly from cash register tapes by department for eight departments in Home Center (Exhibit 6).

2 Purchases--obtained weekly from purchase records for eight departments in Home Centers.

3 Inventory--taken once a year. At the completion of the physical inventory, inventory information is obtained for departments, by store, region and division.

(A format of the management reports developed from this information is included as Exhibit 7; a description of the report is included as Exhibit 8.)

On April 28, 1976 Mr. Dawson sent a memorandum to Mr. Caples, Southwest's Director of Merchandising, proposing a change in the RMIS (Exhibit 9).

This proposal represented substantial change from the current system, increasing the number of product groups from which sales and purchase information were gathered from the current eight to ninety-three (Exhibit 10).

Mr. Dawson noted,

> We certainly need a finer breakdown than the eight we currently have. But over ninety-nine starts getting us close to SKUs, and these will never be captured by cash registers. They're kept by physical inventories. So, I've tried to reach a balance.

Primarily, we really need a system to facilitate merchandise management and store planning. You just can't do good planning with eight breakdowns. Second, we need a system that allows us to reduce inventory overage.

The eight groupings currently used in the RMIS were derived from the Hardware Institute. Most managers believe that these groupings did not reflect well the merchandise carried in home centers. A related problem was that the system, as currently operated, was not flexible enough to accommodate the addition or modification of merchandise groupings. Because of the dynamic nature of the business management believed flexibility to be a critical requirement for any new system.

In outlining his criteria for the development of groupings, Mr. Dawson cited two:

> First is sales significance, either dollar volume or floor space devoted. We could develop groupings such as 'axes and chisels' but that's not as significant as 'hand tools.' Second, it must be a major project grouping such as 'doors and windows' to facilitate comparison by store. If the category's too fine it's meaningless and if it's too broad it is meaningless.
>
> Currently none of the cash registers in our stores will handle the 93 breakdowns I've outlined. (NCR class 5's.) What I would like to do is to implement the system in seven 'Bellweather' stores. This would require us to replace only about fifty registers. After monitoring the sales in these stores and developing an assortment for them, we could use this information to develop plans for our smaller stores based on what we learn.

On May 10, the Operating Service Manager, Dave Bunker, prepared a recommendation for the Vice President of Operations detailing a recommended change in the RMIS. The recommendation broke down products into twenty categories compatible with present merchandise departments (Exhibit 11). The report stated that the ultimate requirement for the system was twenty categories. "This would enable us to track margin and turnover by the twenty categories and thereby produce gross margin ROI figures."

Current registers (NCR Class 5) could record 20

(text resumes p. 214)

Exhibit 7

SOUTHWEST LUMBER COMPANY

Retail Inventory Management Report by Department within Store for the Period Ending

(000's)

Dept. no.	1&2* Net sales	3 SLS/ ft.	4&5 Addn's retail	6&7 End cost end retl	8&9 On hand turns	10&11 %SLS %inv	12&13 Intmu cummu
	MTH	--	MTH	--	--	--	MTH
Dept 1,10,11	YTD	--	YTD	--	--	--	YTD
	LYTD	--	LYTD	--	--	--	LYTD
	%CH	--	%CH	--	--	--	--
Dept 2,3,4	XXX	XXX	XXXXX	XXXX	XXXXXXX	XXXX	XXXX
Dept 12,13							
Dept 17,19							
Dept 5,9							
Dept 6							
Dept 7							
Dept 8							
Total store							

*1&2: This means see explanation 1 and 2 in Exhibit 8. All other numbers above columns likewise refer to the explanation numbers in Exhibit 8.

14&15 Mkdn	16&17 % mkdn	18&19 Gross margin	20&21 % marg	22 Marg /ft.	23 GM ROI	24-27 Salaries $	%
MTH	MTH	MTH	MTH	--	--	MTH	MTH
YTD	YTD	YTD	YTD	--	--	YTD	YTD
LYTD	LYTD	LYTD	LYTD	--	--	LYTD	LYTD
%CH	--	%CH	--	--	--	%CH	--
XXXXX	XXXX	XXXX	XXXXX	XX	XXX	XXXXXXXX	XXXX

Exhibit 7 (Continued)--SOUTHWEST LUMBER COMPANY

Purchases Report, by Store within Department for the Period Ending ($000)

Store no.	6* Purch at retail $	12 MU%	Add'l markup	5 Total $	13 addn's MU%	14-17 Markdowns $	%	Maint'd MU%	1&2 Sales	Addn's/ sales	8&9 On hand turns	23 GM ROI
1010	MTH	MTH	MTH	MTH	MTH	MTH	MTH	MTH	MTH	MTH	(1)	(4)
	YTD	YTD	YTD	YTD	YTD	YTD	YTD	YTD	YTD	YTD	(2)	--
	LYTD	LYTD	LYTD	LYTD	LYTD	LYTD	LYTD	LYTD	LYTD	LYTD	--	--
2770	%CH	--	$CH	%CH	--	%CH	--	--	%CH	--	(3)	--
4530	XXX	XX.X	XXXX	XXXXX	XXX	XXXX	XXX	XXXX	XXXX	XXXX	XXXXX	XXXXX
6060												
6170												
Total												

Notes

(a) To content of each column reports the balances for the current month, current year-to-date, last year-to-date, and % change from last year, except as noted below:

(1) Weeks stock on hand, this year

(2) Weeks stock on hand, last year

(3) Inventory turns based upon 12 month moving average

(4) Gross margin return on inventory investment based upon 12 month moving average

(b) All markup and markdown % calculations are based upon the appropriate additions at retail figure as the demoninator.

(c) The On Hand, Turns and GM ROI balances are identical to those shown on the Retail Inventory management Report.

*6 refers to explanation #6, Exhibit 8. All other numbers above columns likewise refer to the description numbers in Exhibit 8.

Exhibit 8

SOUTHWEST LUMBER COMPANY

Retail Inventory System Description

The purpose of the "Retail Inventory System" is to provide information to store, division and staff on merchandise activity and profitability by department.

The following is a description of each entry on the report:

1. Net sales for the month.
2. Net sales for the year-to-date.
3. Sales per square foot calculated by dividing net sales for the twelve month period ended in the current month by the selling space of the department.
4. Total value of additions for the month at retail, made up of purchases, purchase accrual and additional markups.
5. Total value of additions for the year-to-date at retail.
6. Inventory value at cost at the end of the current month.
7. Inventory value at retail at the end of the current month.
8. Week's stock on hand, based upon the ending inventory at retail divided by the average weekly sales to date.
9. Inventory turns is the number of times the ending retail inventory divides into net sales for the twelve month period ended in the current month.
10. Year-to-date department sales as a percentage of total sales.
11. Value of total department inventory at retail as a percentage of total retail inventory.
12. The initial percentage markup on total retail additions to inventory in the current month.
13. The cumulative markup percentage on inventory at the beginning of the year plus year-to-date additions.
14. Total dollar value of markdowns for the current month net of markdown cancellations.
15. Total dollar value of markdowns for the year-to-date net of markdown cancellations.
16. Current month markdowns as a percentage of current month sales.
17. Year-to-date markdowns as a percentage of year-to-date sales.

Exhibit 8
SOUTHWEST LUMBER COMPANY
Retail Inventory System Description (Continued)

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18. Current month gross margin on sales after markdowns but before shrinkage, miscellaneous freight not charged to a department and rebates.
19. Year-to-date gross margin on sales after markdowns but before shrinkage, miscellaneous freight not charged to a department and rebates.
20. Current month gross margin as a percentage of net sales.
21. Year-to-date gross margins as a percentage of net sales.
22. Gross margins per square foot calculated by dividing total gross margin for the twelve month period ended in the current month by the selling area of the department.
23. Gross margin return on inventory investment calculated by dividing total gross margin for the twelve month period ended in the current month by the average department cost inventory position over the same twelve months.
24. Estimated salaries for the department as reported by the store for the current month.
25. Estimated salaries for the department as reported by the store for the year-to-date.
26. Salaries for the current month as a percentage of sales for the current month.
27. Salaries for the year-to-date as a percentage of sales for the year-to-date.

The following columns have either one or two additional figures appearing in each department:

Net Sales	Gross Margin
Addn's Retail	% Margin
Intmu-Cummu	Salaries $
Markdown	Salaries %
% Markdown	

The first additional figure is the corresponding total for the last year-to-date. The second additional figure is the corresponding year-to-date value as a percentage of the last year-to-date value (or % change).

Exhibit 9
SOUTHWEST LUMBER COMPANY

DATE: April 28, 1976
TO: Mr. T. M. Caples
FROM: William Dawson
SUBJECT: RETAIL MANAGEMENT REPORTS

As discussed some time back, the purpose of this memo is to indicate those product groups within the major home centers that are meaningful to us in Marketing and Store Planning. As we are going to split the cost of maintaining this system, your comments as a full partner would be most welcome.

Some overall comments:

1. We do not find the present department split to be very useful. Our interest is in large blocks within the stores and product groups; the split between 1, 10 and 11 doesn't mean anything to us.

2. The product groups we have recommended are in as fine a breakdown as (Planning) department uses in the 1/4" plans.

Please advise when you would like to review this suggested breakdown.

Exhibit 10

SOUTHWEST LUMBER COMPANY

Product Group Breakdown Proposed by Vice President-Marketing

Hardware
1. Door Hardware (lock-sets, track, knockers, letters)
2. Fasteners (bulk and packaged)
3. Nails
4. Twine and Chain
5. Louvres and Vents
6. Drapery Hardware (incl. chains)
7. Hand Tools
8. Power Tools (hand) and Accessories
9. Stationary Power Tools
10. Cabinet Hardware
11. Miscellaneous Hardware
Lumber and building materials
12. Cedar Lumber
13. Other Dimension Lumber (spruce, fir, hemlock, including strapping)
14. Boards (pine, fir)
15. Miscellaneous lumber (hardwood)
16. Plywood (fir, spruce, handi-panels)
17. Gypsum/Wallboard and Accessories
18. Prefinished Panelling
19. Arborite/Tile Board/Counter-Tops
20. Miscellaneous 4 x 8 sheets (hardboard, particle board, aspenite, etc.)
21. Ceiling Products (tile, lay-in, grid systems)
22. Mouldings
23. Cement Products (or bagged products)
24. Chain-Link Fencing and Accessories
25. Ladders
26. Roofing (roll, shingles, shakes)
27. Doors
28. Windows
29. Insulation (batts, pouring)
30. Siding (wood, aluminum, hardboard)
31. Eavestrough
32. Miscellaneous LBM
Decorator
33. Fireplaces and Accessories
34. Shelving and Accessories
35. Mirrors and Mirror Tile
36. Decorative Wall (cork, burlap, deco-brick)

Exhibit 10

SOUTHWEST LUMBER COMPANY

Product Group Breakdown Proposed by VP - Marketing (Continued)

37.	Decorative Wall (cork, burlap, deco-brick)
38.	Unfinished Furniture
39.	Bars and Stools
40.	Paint
41.	Glues, Caulkings, Coatings
42.	Frames and Prints
43.	Wallpaper and Accessories
44.	Paint Brushes and Accessories
45.	Stain
46.	Miscellaneous Decorator
	Flooring
47.	Roll Carpets
48.	Roll Resilient
49.	Floor Tile (vinyl, carpet, wood)
50.	Area Rugs and Mats
51.	Ceramic Tile and Accessories
52.	Miscellaneous
	Plumbing
53.	Kitchens
54.	Range Hoods
55.	Bathroom Fixtures (tubs, toilets, enclosures)
56.	Fittings
57.	Packaged Plumbing
58.	Vanities
59.	Bathroom Accessories and Hardware
60.	Pumps, Heaters, Vent Kits
61.	Weatherstripping
62.	Humidifiers and Filters
63.	Heating (ducts, etc.)
64.	Sinks, Faucets, Laundry Tubs
65.	Miscellaneous
	Electrical
66.	Light Fixtures
67.	Bulbs
68.	Wire and Cord
69.	Flashlights and Batteries
70.	Lamps
71.	Electrical Fittings
72.	Clocks
73.	Home Comfort (baseboard heaters, fans, etc.)
74.	Miscellaneous Electrical

Exhibit 10

SOUTHWEST LUMBER COMPANY

Product Group Breakdown Proposed by VP - Marketing (Continued)

	Housewares
75.	Gourmet
76.	Rattan
77.	Rubbermaid/Plastics
78.	Brooms/Brushes/Cleaning Supplies
79.	Traffic Appliances
80.	Cookware
81.	Miscellaneous Housewares
	Seasonals
82.	Toys
83.	Trim-The-Home
84.	Garden Furniture
85.	B-B-Q and Accessories
86.	Camping Supplies, Sporting Goods
87.	Snow Removal
88.	Mowers, Tillers, Spreaders
89.	Garden Tools
90.	Garden Supplies
91.	Sheds
92.	Horticulture
93.	Miscellaneous Seasonal

Exhibit 11
SOUTHWEST LUMBER COMPANY
Product Group Breakdown Proposed by
Operating Services Manager

Category	Department
1. Builders Hardware	1
2. Dimension Lumber	2
3. Plywood and Particle Board	3
4. Panelling	3
5. Wallboards and Ceiling Tile	4
6. Moulding and Trim	3
7. Roofing and Insulation	4
8. Windows, Doors, Sash	4
9. Fencing and Bag Goods	4
10. All Other Building Material	4
11. Home Decorative	5
12. Flooring and Ceramic Tile	6
13. Plumbing and Heating	7
14. Electrical	8
15. Paint and Wallpaper	9
16. Nails, Fasteners, and Hand Tools	10
17. Power Tools	11
18. Housewares	12
19. Appliances	13
20. Seasonal	19

categories of sales, but could not record the 93 breakdowns initially recommended by Mr. Dawson. However, it was learned that new machines (NCR 250) could be purchased or leased at approximately the same cost as older machines. These new machines were capable of producing the ninety-three hard sales totals proposed by Mr. Dawson, or expanding the system proposed by the Operating Services Manager.

Mr. Dawson supported these recommendations as a major improvement over the current system and believed that Dave Bunker's twenty groups and his ninety-three could be reconciled without too much difficulty. However, some members of the mangement team were less enthusiastic. Mr. Caples had responded negatively to Mr. Dawson's April 28 proposal in a memorandum (Exhibit 12) and shortly thereafter had left the company. His position had not yet been replaced, and the Merchandising function was currently being looked after by the Senior Vice President of the RPD. Mr. Dawson believed that the Senior Vice President would support any well researched change in the present system. Mr. Dawson thought that these changes should include forwarding the RMIS information to the Group Merchandise Managers who had not been receiving them to that point.

Management Response

Joseph Devereaux--Group Merchandise Manager Joseph Devereaux had been with Southwest Lumber for about one year. His principal responsiblity was hardware products. He described his job as follows:

> Basically, my job is to rebuy for the distribution center. I receive weekly printouts from the distribution center on product movement and use these as a basis for reordering. Orders for products are made strictly by SKU, not by store or geographic area. This sometimes is a problem if we have one item that is not moving well in a particular area of the country, but I don't think it's much of a problem.
>
> One problem I have is that basic store assortments are determined by Division, not Merchandising. I don't have any field input into developing store assortments. Even when store managers or my buyers recommend a new item be placed in the assortment, Division may or may not follow that recommendation. I don't know on what basis they make assortment decisions. (The word

Exhibit 12
SOUTHWEST LUMBER COMPANY

DATE: May 19th, 1976
TO: W. K. Dawson
FROM: T. M. Caples
SUBJECT: NCR Retail Management Reports

Reference your letter of April 28th regarding the above. While I feel that your desire to realign the product groups may have some merit, I do not know how your recommendations can be meaningfully implemented at the store level.

Their base reference material is the current merchandise departments and groupings, which is referenced by the house number. I do not believe it would be viable to ask the stores to categorize merchandise at either the inventory input level or at the point of sale by the cashiers, since arbitrary decisions would have to be made at both of the aforementioned areas, which could result in less accurate information than we are able to obtain to date.

I would be happy to discuss further with you at your convenience.

Division refers to the heads of the various groups of stores within the store operations pyramid referred to on page 194 and illustrated on page 195, Exhibit 5.)

A second problem that concerns me is advertised specials. Stores order about three months in advance and store managers theoretically are supposed to work with my buyers to determine how much to order for advertised sales. This becomes a problem because Group Merchandise Managers don't have any input into determining what is advertised and when. Sometimes we have stockouts and other times we are way overstocked.

I think we're really weak on policies and procedures. The store managers up until recently have been too independent. We used to have a lot of unauthorized buying which played havoc with the Group Merchandise Managers' decisions. I would really like to see the store managers forced to use some kind of assortment. This would help us in our forecasting and cut down on stockouts and overstocking. Once we have determined store assortments and stick to them we can use store level information for Division assortment, buying and advertising decisions.

Mr. Deveraux said that he didn't receive any RMIS reports and, in fact, had never heard of them.

San Phillips--Group Merchandise Managers Sam Phillips was Group Merchandise Manager for Plumbing, Heating and Electrical Supplies. Unlike Joseph Devereaux's group, only about 65% of plumbing and heating supplies and 45% of electrical supplies were shipped to stores through the distribution center.

This leads to occasional outside buying by store managers. This is really tough to police because it's impossible to standardize the assortment due to variations in building codes across the country. On top of this, the store managers don't have much discipline.

We don't get any information on what is being sold by store. All we know is what is shipped from the distribution center. Consequently, we have a problem with inventory excesses in stores, which has abated somewhat since the distribution center was set up.

I really don't have adequate information to work on. I need sales breakdowns by SKU by month by region by store type. Then we could analyze store sales and get slow SKUs out of the line. In addition, it would help us get new products into store assortments. Right now new products get into the assortment too slowly. We develop a marketing plan of sorts describing where we are weak in our assortment and where we are strong. Then we go product by product, market by market to look for product deletion and addition possibilities.

I would like to take all the buying and reporting functions away from the store managers and have all the information I need run right off the cash register. Central buying is crucially important.

Store Management

Store managers were sometimes critical of the attempts by management to control inventories. These managers were paid a salary plus a bonus based on store profits. The average home center manager earned about $24,000 in 1976.

Store managers were charged "Interest on Controllable Investment" amounting to one percent per month on inventory and accounts receivable. Dave Bunker noted, "Because this charge affects profits, and therefore bonuses, there's an incentive to keep down inventories, but it doesn't seem to work very well." He continued:

> There is one heck of a problem with controlling inventories. The stores are currently three million dollars over inventory. There should be more control over open to buys. Until the store returns the invoice the Division doesn't know how much stock at what cost is in the store. Store managers are supposed to report weekly what they ordered but they don't. What happens is that store managers underreport and consequently there is overstocking on some items.

Management thought that underreporting was caused by store managers believing they needed more stock than the Division did for seasonal items or unusually heavy sales. This occurred because of past mistakes by Division in anticipating seasonal sales.

No store managers had been fired or seriously reprimanded for being substantially over inventory. As Mr. Dawson

put it, "Some store managers are lousy at inventory management, but good in other areas such as increasing sales, service, or keeping costs down."

Jerry Stinson, Manager for Market Planning and Research, summarized the situation in the following manner:

> Southwest is a typical retail subsidiary. Pedley management is unsatisfied with our ROI and look at every capital project on a discounted cash flow basis.
>
> The old Southwest people are retail oriented. They think in terms of local market competition, local market buying, maximum decentralization. They are very entrepreneurial in nature.
>
> Top management personnel and responsibilities have been changed frequently in the past few years. The president, who comes from Pedley's, is in a position of balancing Pedley's demands and the old line Southwest people. The Senior Vice President has been with Southwest for several years, and he is taking over Merchandising until a new V.P. for Merchandising is found.
>
> MIS occupies a peculiar position. The head of the MIS department comes from Pedley. The MIS management reporting forms have changed each time the reporting system has changed. But MIS has not researched the needs of potential users as well as they might have in developing new systems. Administration controls the distribution of reports and Merchandising people don't receive them. Consequently, the reports produced so far haven't been useful to management although I believe that Bill Dawson and his store planning people use them to allocate space to the individual departments.

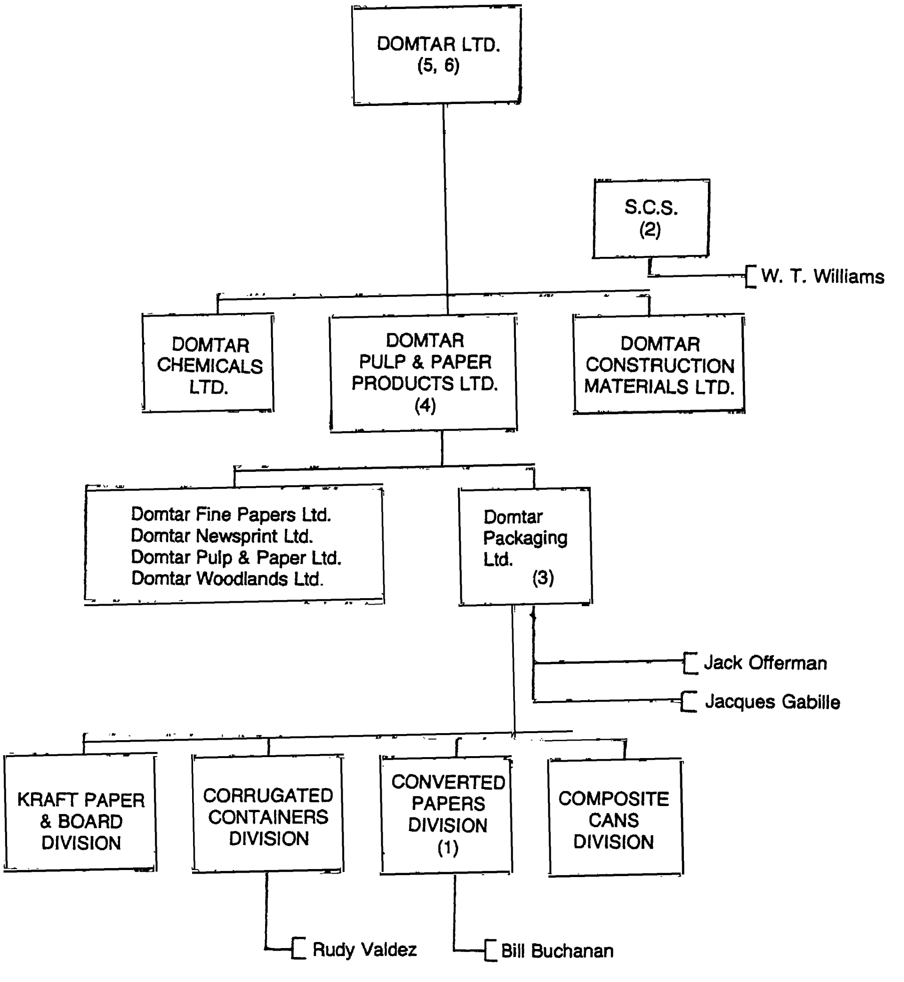
Domtar Packaging Limited

INTRODUCTION

Messrs. Gabille, Offerman, Buchanan and Valdez spent the afternoon of November 1, 1973 discussing how their Request for Systems Implementation (RSI) would be received as it was pushed up the corporate ladder, towards final approval. Domtar's development policy required that RSI's for new projects be assessed and approved, according to specific guidelines, by certain managers depending on the nature and magnitude of the project. In this instance the approval process required that six different managers assess the merits of the projects (see Exhibit 1). First, the General Managers of the requesting divisions would evaluate the RSI to see that their needs would be met. Second, the director of the corporate computer services must agree: that manpower durations are realistic; that development costs are suitable and the job can be done within the range specified, with procuring any equipment defined in the RSI; that the cost/benefit figures are acceptable. Third, the Vice President of the operating company, Domtar Packaging Ltd., would have to accept the ongoing operating cost for the system and the development costs to implement it. Fourth, the President of Pulp and Paper Products Ltd. would approve the RSI on the same criteria as the Vice President. Fifth, the Corporate Vice President of Finance must be prepared to spend the funds indicated to develop the project. And last, the President of the Corporation must give his approval before development could begin.

The four systems analysts, Gabille, Offerman, Buchanan and Valdez, had begun their study some seven months earlier in the year. By summer they began to propose a decentralization of some of the activities previously centralized with the corporation's Systems and Computer Services (SCS) group. The RSI would soon be on the desk of the Director

Exhibit 1*
DOMTAR PACKAGING LIMITED
Partial Organization Chart



*The numbers within parentheses indicate the corporate location of the various individuals who must approve an RSI.

of SCS, Mr. W. T. Williams, for his stamp of approval, and Mr. Gabille was concerned that the Director might not give the necessary okay. The RSI recommended an alternative that was aimed away from the centralization of computer services that SCS had been working towards since 1969. Their recommendation was a slightly more expensive approach than a more centralized one and would also reduce the influence SCS presently had over the operating divisions. If approved and successfully implemented the proposal might encourage other divisions to turn against the centralized systems approach of SCS.

COMPANY BACKGROUND

Domtar Ltd., the large Canadian parent corporation with head offices in Montreal, Quebec, managed its operations through three operating companies, each representing a major product group. Domtar Chemicals Ltd. and Domtar Construction Ltd. had sales of $85 million and $111 million respectively in 1972. Domtar Pulp and Paper Products Ltd. managed its domestic and foreign operations through five major operating divisions: Fine Papers, Packaging, Newsprint, Pulp and Paper and Woodlands. During 1972, about 68% of the group's sales were made in Canada (primarily Fine Papers and Packaging Products), 20% in the United States (mostly Newsprint and Pulp), and 12% in other foreign markets. Sales totaled $365 million for the group, with Packaging contributing nearly half that amount. Growth in sales amounted to 8% between 1971 and 1972.

Domtar Packaging Ltd. was again broken down into operating divisions according to four product areas: Kraft Paper and Board, Composite Cans, Corrugated Containers, and Converted Papers. Most of the operating divisions had headquarters in Montreal. Domtar Packaging Ltd., too, had its head offices in Montreal.

The Converted Papers Division of Domtar Packaging Limited was a manufacturer and distributor of a great variety of paper products with three plants at the following locations: Malton, Ontario (Towels, Napkins, Diapers, Paper Bags, Plastic Bags); East Angus, Quebec (Grocery Carry-Out Bags); Windsor, Quebec (Notion Millinery Bags, Industrial Papers); and eleven distribution centers located at: St. John, New Brunswick; Halifax, Nova Scotia; Montreal, Quebec; Ottawa, Toronto, Sudbury, London, Timmins,

and Thunder Bay, Ontario; Winnipeg, Manitoba; and Saskatoon, Saskatchewan. The division was strongly marketing oriented. Its staff of 70 salesmen serviced approximately 10,000 individual customer locations across Canada. At the distribution centres, finished goods inventories, covering an average of 2,000 different stockkeeping items and valued at approximately $5 million, were maintained.

DATA PROCESSING HISTORY

Up to 1969, each operating division of Domtar performed its own data processing functions, with each division developing different accounting methods to suit individualized needs. There were small IBM systems located in Toronto, Windsor and Montreal, while the mills and plants used TAB equipment to produce some sales analysis and other reports for management.

In 1969 a decision was made to centralize, as much as was possible, the EDP services in Montreal, which would provide the nucleus for a corporate-wide data processing system. Certain problems hampered this effort, however. For example, in one division a proposed MIS never really got off the drawing board. Mr. Gabille felt the main reason that this particular MIS bogged down at the systems design and programming stages was that the estimated cost to complete became $100,000 greater than the original $100,000 budget. Although some progress was being made in the centralization efforts, the company was not attempting to create a single monolithic MIS in Montreal.

To Mr. Gabille, the reasons for some of these centralization problems were obvious. First, he observed, the corporate systems and computer services lacked the personnel capabilities to implement such a large and complex undertaking. Second, SCS failed to adequately consider the needs of the users and producers of information at the plant level. The result was that, by 1973, the divisions were growing tired of the delays and were beginning to lose interest in SCS's centralized system. It was in this light that Domtar Packaging Ltd.'s management formed a project team in April 1973 with the following mandate to:

> Investigate and develop alternatives which will effectively eliminate the data-entry inefficiencies at Converted Papers and Corrugated Containers while

improving the clerical operations at the plants and branches. Both in-house and outside solutions, as well as combinations of in-house and outside solutions, were to be investigated. In this context mini-computer and new communications technology were to be considered. Overall objective was the least-cost solution for Domtar which at the same time filled user needs effectively. Costs of different alternatives were to be compared on a full-cost as well as an incremental cost basis. Target date for RSI documentation and completion of study was August 10, 1973.

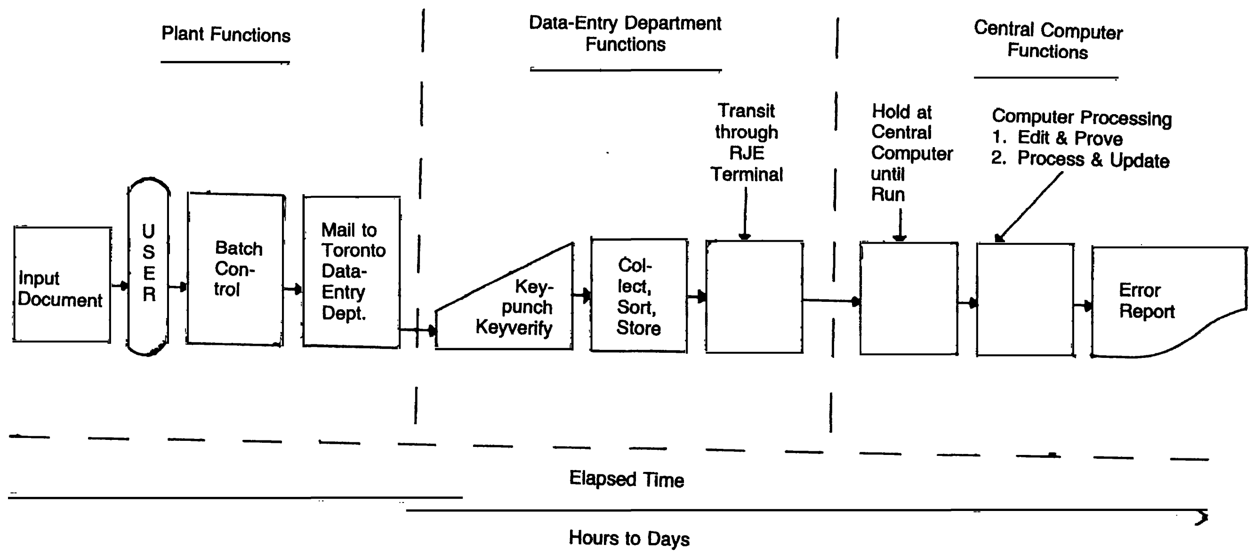
The team consisted of Jacques Gabille and Jack Offerman from Packaging Headquarters, Bill Buchanan from Converted Papers and Rudy Valdez from Corrugated Containers. The inefficiencies that were to be eliminated in each of the two divisions were different due to the differences in operations, but they shared similar underlying causes.

THE PROBLEMS

The study team approached their assignment by first identifying the specific problem areas. This was accomplished by interviewing information users and through detailed analyses of the existing information system. To aid in the analyses, the group constructed the detailed flow charts of existing portions of the system such as the one for accounts receivable shown in Appendix A. Through the above process, the study group was able to identify the general problem areas as:

a Inefficient Method of Data-Entry. The expansion of central EDP facilities during recent years had generally increased the efficiency of storing and processing large volumes of data. Data-entry, which was the collection, editing and presentation of data to the computer, had not kept pace with this development. Many present-day computer systems handled quite effectively the processing and storage functions through a central computer, but were very inadequate as far as methods of getting the data into the computer in machine-readable form, and returning and presenting required information in useable format to the systems users. Because of space limitations this case presents details primarily relating to the Converted Papers Division.

Figure 1
DOMTAR PACKAGING LIMITED
Typical Batch-Processing Sequence



This is illustrated by the typical sequence of steps associated with the present batch-processing system that is shown in Figure 1 on the preceding page. In this sequence, copies of source documents were batched daily and mailed to a central facility for keypunching and key verification. Punched cards were forwarded to the computer centre for sorting, editing and balancing. Error reports, which identify items unacceptable to the computer system, were returned to the keypunch department for correction. But usually, the keypunch section did not know the business well enough to make the necessary corrections and the error reports had to be sent back to the originating locations. And here, the entire cycle started all over again.

b Lack of Up-to-Date Information. It was obvious from this description of existing data entry methods that the flow of data into the computer was not only unduly slow, but also tended to make the computer files useless for inquiry-type information needs (credit status, inventory status, etc.), since the files were usually not up-to-date.

At the month end, as during the month, a substantial number of errors remained in an error suspense file, as corrections did not reach the computer centre in time. This obviously degraded the usability of the monthly sales and accounting and cost reports.

c Remoteness of User and System. Since the user was only very loosely connected to the system via mail or courier service, and since the responsibility for accurate input was shared among the user, the keypunch department and the computer facility, it was very difficult to establish the guilty party in case of errors. There was a tendency for one party to accuse the others of inefficiency and high error levels. This type of situation was a natural consequence of the methods employed.

d High Cost of Data-Entry. Data entry to the computer in a typical batch system was very costly. This was partly due to the inefficiency of the system as explained above and further accentuated by the constantly rising costs of clerical operations.

The divisions were dependent on clerical help for the support of most of their vital day-to-day operating functions, such as order-entry, invoicing, pricing, and inventory control. With the exception of "after-the-fact" error-reports on the invoicing input, none of these functions received computer-assistance under the present system. This did not present a serious problem in the early sixties when competent clerical help was still plentiful and reasonably priced. Sky-rocketing clerical salaries and much greater mobility for competent clerical staff to move into technical fields, had left the divisions with a clerical work-force which was getting too costly in relation to its productivity and was also subject to a high turnover rate. The high turnover caused extra costs in training new personnel and this had become an ongoing task not handled too well under the general shortage of competent clerical staff to assume the training responsibility.

In the case of Converted Papers and Corrugated Containers, the data entry cost was approximately $100,000/ annum for each Division.

e Inventory Control. In the area of inventory-control, replenishment decisions were left in the hands of relatively unskilled clerical people, who had only a superficial understanding of inventory-control theory. As a consequence, overstocking of some items and understocking of other items at the branches' warehouse was common. This left available inventory which was poorly matched to the needs of the business. Apart from the impact on inventory level and mix, the dependency on clerical help at the branches for replenishing of inventory frequently resulted in the loss of quality discounts due to ordering of lower than optimal quantities of merchandise from outside suppliers.

f Lack of Computer Support for Clerical Operations at the User Locations. The computer was used nearly exclusively for historical, after-the-fact reporting. No computer assistance was offered to the clerical operations at the plants and branches. Dependency on clerical skill alone made tasks such as invoicing, accounts payable processing, inventory control, payment allocations, etc., inefficient and error-prone.

g Inadequacy of Batch-Processing Method to Cope with Problems. A computer system which operated in

batch-mode was too slow and not responsive enough to effectively handle the needs for fully up-to-date information (current stock-status, current prices, etc.) as demanded by the dynamic inventory and pricing environment of the divisions. This was especially true in view of the widespread geographical distribution of the divisions' service centres which would make service from a central computer in batch-mode impractical, largely because of the inherent time-delays of this type of processing.

THE OBJECTIVES

After reviewing the general problem areas, the study team felt that a set of project objectives would be helpful in the development and evaluation of solution alternatives. The objectives were as follows:

To provide an improved method of data entry resulting in faster and more direct data flow into the computer, reduced error level, and reduced staff costs;

To provide management with a tool which could be used to closely control inventories and accounts receivable and thus enable the division to reduce the current investment in these areas;

To eliminate those clerical operations within the distribution/accounting function which could be handled better by the computer, while increasing the efficiency of the remaining clerical operations;

To make up-to-date information available to the system users. Administrative functions such as credit control and inventory control could be handled more efficiently if status information could be extracted from up-to-date files. If such capability was provided as a by-product of regular data-entry operations, significant clerical savings could be achieved.

To improve the level of customer service through faster order turnaround, fewer stockouts, and fewer processing errors in customer transactions;

To provide support for clerical operations of branches and plants. Routine clerical operations, such as invoicing, payment allocation, accounts payable processing, and pricing should be made more efficient and show a reduced error-level. To achieve this, the user must be able to readily obtain the required information for these

operations such as prices, customer names and addresses, product descriptions, etc.;

To establish a close link between the user and the system. For the user to be responsible for input and receive output from the system when needed, a close, interactive relationship with the system is necessary. The user should be able to enter and correct input data without intervention by other parties;

To make full use of efficient batch-processing capability of the central computer. Data processing operations requiring large storage and/or computer power were best handled on the Central Computer. Examples were the Corrugated Cost System and the massive statistical file up-dating requirements of the Converted Papers sales system. Other functions, such as routine editing, balancing and formatting did not warrant the involvement of the central processor with its high overhead. Such functions were best pre-processed on a mini-computer or intelligent terminal.

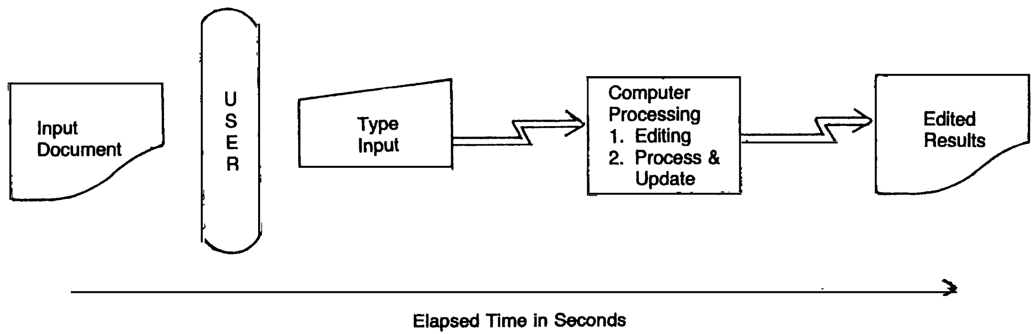
ON-LINE SOLUTION

On inspection of the problems and resulting objectives the study team felt that on-line processing would be needed, at least in part. The significance of on-line processing of a typical business transaction [(Figure 2) lies in its contrast] with the same transaction handled in a batch-processing mode [Figure 1]. (See Appendix A for a comparison of how an accounts receivable application in an on-line mode would differ from the batch-processing application.) These differences gave rise to important advantages for the systems user:

- The greatest advantage was the simplicity of the operation, as far as the user was concerned. For example, since all pertinent information would be stored in the computer and instantly accessible, the operator need only press a few keys to generate a complete invoice. The need for skilled personnel was therefore drastically reduced.

- The accuracy of such a system was high. Because the computer would be programmed to edit input data, invalid codes, improper sequences, and other errors would be immediately detected and rejected by the computer before printing and processing occur. The operator

Figure 2
DOMTAR PACKAGING LIMITED
On-Line Processing Sequence



would be immediately signalled on making an error and informed of the nature of the mistake in order to correct it before it was entered in the system.

- The transactions would be immediately entered into the system; all records affected would be up-dated. Random inquiries (credit status, inventory status) to these records would reflect the most current data.

- Since all records would be up-dated instantly, month-end closing could begin the minute the last transaction was processed. Clean data could be transmitted almost immediately to the central computer to initiate the off-line reporting system. Since processing took place throughout the month, the errors would be corrected on-line, no month-end peakloads would occur and this would tend to bring about a better balance in the utilization of hardware resources.

- Each operator at the different branches and plants would have the impression of having his or her own computer. This was possible because of the difference in speed between the internal operations of the computer and the performance of external functions such as the reading of a line of information, the printing of a line, and especially the manual keying of data. For example, keying a quantity and an item number for an invoice took at least two seconds; and when allowance was made for handling records, it usually averaged several seconds.

- The internal speed of the computer on the other hand was quite high. The computer performed the file lookup, internal calculating and information up-dating required for one line of a typical invoice in a fraction of a second. Thus hundreds of other lines could be processed internally by the computer in the same time that was required to key the data and print one line. Processing was therefore done so rapidly, that there would be no perceptible delay between the end of the operator's keying and the beginning of the actual printing, even if all operators at the different plant locations should reach this point in their processing at the same instant.

ALTERNATIVES

With the above discussion of the need for an on-line system in mind, and using the objectives as guidelines, the four analysts considered several alternatives in their study. They were as follows:

a Outside Timesharing-Service Approach

KEYDATA's on-line, real-time commercial data processing system was investigated. This timeshared system was developed by the Keydata Corporation of Boston, Massachusetts, and it handled all normal commercial applications from order processing through financial statements including invoicing, accounts receivable, inventory control, sales analysis, accounts payable and general ledger. The on-line system featured credit checking, notification of inventory reorder and out-of-stock conditions, plus partial shipment and back order processing, all on an automated basis. The project team looked at the feasibility of combining the on-line system as offered with the off-line report system maintained on Domtar's central computer. The drawback of the KEYDATA system was its high cost to users with high volumes since price was proportional to the transaction volume. KEYDATA had, therefore, much more appeal for small and medium-size companies, but became uneconomical for companies such as the Converted Papers and Corrugated Containers Divisions of Domtar.

DATACROWN, the other large computer utility which utilized an IBM 370/168, capable of supporting the necessary on-line functions, was also investigated by the study team. They quoted costs that were marginally lower than SCS charged to Packaging, but higher than the incremental cost of Domtar Ltd. (if the processing was done on the central computer). In view of this higher out-of-pocket cost, this alternative was not further pursued.

b Intelligent Terminal Approach

This approach related to the concept of distributed intelligence involving the placement of stored logic in terminals at various points in a data communications network. In terms of the team's specific project, an intelligent terminal could have been used to perform editing functions as invoicing while concurrently creating input for the central computer system. In this manner, the central CPU could have been relieved of routine editing and balancing functions, while the input responsibility was back with the user.

An example of a successful application of this concept was Containerboard invoicing in the Kraft Paper and Board Division. Burroughs TC-500 computers (mini)

were used for this application at Red Rock and at Division Headquarters in Montreal. Communications with the central computer for the purpose of weekly and monthly reporting were in an off-line mode, using a paper-tape to magnetic tape conversion. While this approach achieved company objectives in the case of Containerboard, the task force did not find this solution satisfactory when using the TC-500 in an off-line mode of operation. The main reasons were the following:

> Difficulty to contain master file data in available core of the TC-500 terminal restricted the editing capability; and cost of the system was relatively high, since the divisions would be facing a low degree of utilization of the terminals at the smaller plants.

However, the project team liked the TC-500 terminal for its ease of operation and was considering a stripped version of the TC-500 as a possible terminal to be used at the plants (see Appendix B).*

c SCS Approach

The feasibility of expanding the central computer capability to allow it to handle the project's requirements was also seriously investigated in conjunction with SCS personnel.

Performing all processing at the central computer represented an alternative solution to using the mini-computer as intermediate processor between the users at the plants and the central computer. In this case, terminals and lines would be connected directly into the central computer, and no secondary processor would be needed at division head office.

On a full-cost basis, this alternative would be more expensive for Converted Papers than the mini-computer alternative. However, the central computer alternative showed marginally lower incremental costs for Domtar.

In any case, the out-of-pocket costs of the two approaches were not significantly different. This is

*All figures in the appendices and elsewhere in the case, unless otherwise stated, pertain only to the Converted Papers Division. The study team prepared similar data for the Corrugated Containers Division.

shown below:

Present Value of Out-of-Pocket Costs over 8 Years		
Central	Mini	Advantage central
$1,331,383	$1,404,579	$73,195

A similar small advantage for the central system was found for the Corrugated Containers Division.

d Multi-Terminal Mini-Computer Approach

This was another form of "distributed intelligence". In this case, a mini-computer controlled a cluster of terminals and fed computing power to them. The mini-processor had the functions of controlling the remote terminals through computer programmes. The mini-computer in conjunction with the remote terminals was capable of achieving the same results as the intelligent terminals--in a different manner. While in the case of the intelligent terminal stored loci was physically placed at each plant location, the multi-terminal mini-computer approach provided the stored logic via communication lines to the plant locations. Each terminal operator could have been guided and assisted by the remote mini-computer which was capable of supporting all of the terminals of a Division concurrently.

The diagram in Exhibit 2 illustrates the system configuration for Converted Papers. The concept of this approach had special significance to Domtar Packaging for the following reasons:

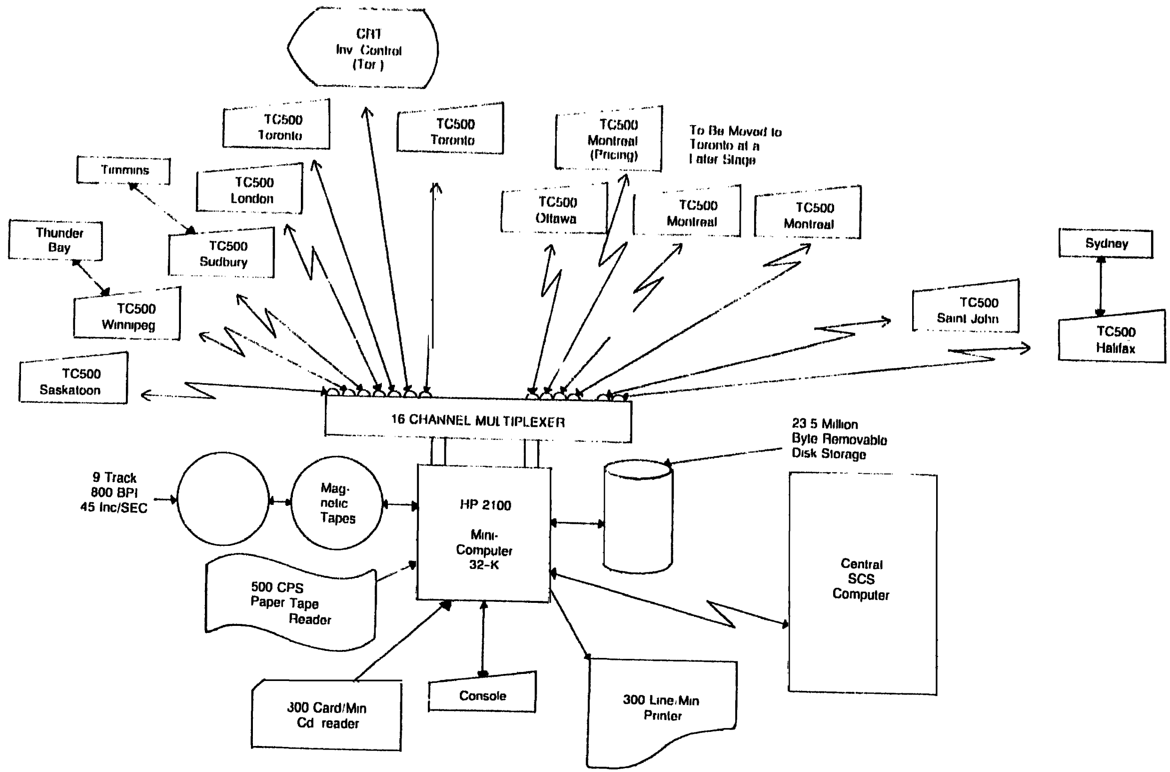
It provided computing power to the plants to handle their day-to-day operations, while leaving the heart of the system at division head-office. This allowed effective communication between plants and head office. It also assured a standardized approach to programme-development for the divisions, which would be more difficult to achieve under the intelligent terminal approach.

By looking after the daily on-line operations and editing functions, the mini-computer relieves the central computer from the chore of polling lines, editing input and servicing multiple terminals concurrently. The mini-computer would have handled such tasks effectively and economically.

Exhibit 2

DOMTAR PACKAGING LIMITED

Converted Papers Division, System Configuration and Telecommunications Network



The impact of computer failure under this approach localized the downtime problem at the divisional level, rather than affecting all of Domtar, which would be the case if all operating companies were connected on-line to the central computer. File recovery tasks, restart and backup procedures would have been less complex if dealt with on a divisional basis.

In conjunction with the efficient batch processing capability of the central computer, such a system would have optimally served the different levels of user management:

- The remote terminals bring computing power into the plants and will help rationalize clerical and administrative plant functions (invoicing, pricing, accounts receivable processing, accounts payable processing, general ledger and profit and loss preparation).
- The mini-computer at division head-office would at the same time have been capable of filling the information needs of head-office personnel more effectively than was presently possible under the batch-processing scheme. The link between the mini-computer and the central computer would have been used to transmit urgent reports to division head-office. In this sense, the mini-computer assumed the function of a remote batch terminal. Maintenance of divisional files was best handled at the division head-office location where this function was performed. Placing the mini-computer at division head-office would have facilitated this task due to the greater ease of access than existed with the central computer. Programme maintenance of application programmes and the effective monitoring of terminal/mini-computer communications were also most effectively handled at division head-office.

It took optimum advantage of new developments in data-communications.

The recently announced (April 1973) digital data communications network offered by the common carriers (Bell's DATAROUTE and CN/CP's INFODAT) reduced considerably the cost constraint that had made data communications networks poor economics for most companies. The new digital

networks were offered at rates substantially below the old private wire rates previously offered by the carriers. Rates dropped by an average of 25% and as much as 90% in the narrow band services that the divisions would generally employ.

Example: Montreal-Toronto--previous $1,355 (for 300 baud, 24-hour service)--now (digital) $157 (for 300 baud, 24-hour service).

The new rates were less sensitive to distance but were based primarily on the difference in line speeds, favoring the lower speeds (a 2400 baud line costs roughly eight times as much as a 300 baud line).

Apart from the cost aspect, the digital networks would have been better suited to data-communications than the previous analog networks. Initially, eleven major centres would have been linked by networks. Others would be added as market volume warranted it.

In terms of the specific project, the study group found this development to favour the multi-terminal mini-computer approach. In terms of total systems operating costs the network cost was no longer the major element.

RECOMMENDATIONS

Having examined the various alternatives the study team made the following recommendations in the RSI.

1 Recommending the Multi-Terminal Mini-Terminal Computer System

The group's analysis showed that both the mini-computer alternative as well as the central computer approach were feasible and economically sound. On a full-cost basis, the mini-computer solution was more attractive, while on an incremental cost basis, the central computer approach showed marginally lower costs.

Seen from a Domtar Packaging point of view, the slight incremental cost advantage of the central computer alternative was offset by the following factors:

The mini-computer system would not compete with other projects which were to be implemented on the central computer within the same time frame.

It would draw from its implementation and operation primarily on existing manpower resources at the division and operating company level.

The mini-computer system would improve applications which have been traditionally under the responsibility and control of the division (data-entry functions to central computer, invoicing and pricing). Through the day-to-day exposure of these applications, the divisions had a thorough knowledge of the requirements. This, the team felt, would help the divisions to successfully implement the system.

The mini-computer system limited itself to a narrow range of applications. Hardware, software and manpower resources were dedicated to the smooth functioning of the applications. The study team believed that such limitation of the scope of the system would allow the divisions to concentrate on their effective implementation and operation.

The placement of the mini-computer system at division head-office put it directly into the lap of the user organization. This was important in terms of backup resources, but furthermore allowed the mini-computer personnel to identify closely with the goals and objectives of the division.

The expertise developed during the implementation of the mini-computer system was transferrable to other groups in Domtar as SCS intended to add one person to the project team.

While some of the smaller off-line reports would have been produced at the mini-computer facility, all the large reporting requirements of the division would continue to have been provided by the central computer at Domtar House. The reports referred to dealt with the following application areas:

- Sales and Accounting
- Inventory Control
- Accounts Payable and General Ledger

In the area of sales and accounting, the accounts receivable trial balance and the customer statements would have been charged to an open-item format. The frequency of the trial balance would have been increased from monthly to semi-monthly.

In the area of inventory control, monthly performance, demand and stock status reports would have been a new

addition to the processing load at the central computer. The input for these reports would have been transmitted from the mini-computer in file-format.

As far as accounts payable and general ledger reporting were concerned, the team expected to use an application package from an outside software house. In this connection, the team worked closely with the corporate systems department and with other interested users of Fine Papers and Domtar Construction.

The study team preferred the mini-computer approach since the mini-computer system could have been tailored to the exact needs of a certain range of applications and be placed directly within the main user organization it had to serve. This physical presence of the system was not achievable to the same degree by a system which resided on a remote central computer. Having the divisions' own people do as much of the development and operation of the system as possible "kept the doctor in the house" and again could not have been done through the central approach, where a high degree of dependence on people who were skilled technicians but not familiar enough with the business problem was unavoidable. All things considered, the team believed that the mini-computer approach would have been more efficient for the applications considered.

The team noted, however, that the central computer had an important share in processing the divisions applications. Essentially, the mini-computer would be used for all on-line, real-time processing (preparation of invoices, application of customer payments, updating of inventories, retrieval of prices, cost and inquiries into credit status, inventory status). All month-end reporting, on the other hand, would be handled by the central computer using data prepared by the mini-computer system.

2 Recommending Hewlett-Packard as Mini-Computer Supplier

The study team strongly recommended Hewlett-Packard's System 2100 for the following reasons:

Hardware and software offering fit project requirements; Hewlett-Packard was strong in the area of mini-computer based on-line systems. The hardware recommended for the

system was well-proven (approximately 6000 H.P. 2100's were sold at the point of writing.

Hewlett-Packard was a successful and financially sound company (1972 sales $475,000,000, net income $38,500,000).

Hewlett-Packard's support strength in the area of systems analysis and design had become apparent when H.P. spared no effort to assist the project team in the study. H.P. contributed approximately 5 man-months to the current project. H.P. was prepared to contractually dedicate systems analyst support and data centre facilities to Domtar (at no extra cost).

3 Selection of Terminals and Communication Lines

The requirements suggested the use of teletypewriters producing hard-copy output rather than display type terminals (CRT's). Two alternate terminal solutions were considered by the project team. The one which was best suited would have been selected in conjunction with Domtar's telecommunications department. Ease of operation for the terminal operator was the primary concern. (See discussion on alternate terminal solutions, Appendix B.)

The choice of supplier for the communication lines was to be determined by Domtar's telecommunications department. Both Bell Canada and CN/CP had identical offerings as far as the new digital data communications network was concerned. In this specific case, three plants fell outside of the digital networks. For these locations, the traditional analog network would have to be used.

COMBINED VS. SEPARATE SYSTEMS

As the study progressed, it had become apparent that there was some dissention among members of the study group, and others, concerning the combining of both divisions on one mini-computer. Such a combining would have saved the firm 14% mainframe costs while still meeting the objectives. Mr. Buchanan and Mr. Gabille felt that any savings in hardware costs would be outweighed by other factors such as increased development costs, decreased reliability and limited core capacity that might have been exceeded in the future. Mr. Gabille's views eventually prevailed, but because of the recent dissention on the issue it was decided that the factors favouring a dual system should

be presented in the RSI. The following paragraphs summarize these factors.

If hardware costs were the only criteria, cost of a combined system would have been $37,000 lower than that of two separate systems. However, there existed other offsetting factors which favoured two separate systems.

Also a combined system would necessitate higher systems analysis and programming costs than would have been required for two separate systems. This did not apply in the case of Accounts Payable, which was not functionally different between the divisions and lent itself to shared development. Invoicing, on the other hand, needed considerably different treatment in Converted Papers as compared with Corrugated Containers. To generalize and define an invoicing programme which would be capable to look after the requirements of both divisions would have been very difficult and needed considerably more systems analysis and programming effort than was required for two separate programmes. The team estimated the increased cost of programming a combined system at approximately $20,000. This reduced the hardware cost advantage noted above to $17,000. This cost advantage was further offset by the following very important aspects of systems operation and expandability.

Response time may be defined as the time interval between the operator's pressing the last key and the terminal's typing the first letter of reply. More generally stated, response time was the interval between an event and the system's response to the event.

The more terminals that are connected to any on-line system, the more difficult it becomes for the computer to provide adequate response times to the individual terminals. The study group estimated that for a combined system the response time at the terminals would approach 3 seconds under heavy loads (2 seconds was desirable to prevent operator fatigue and assure effective terminal throughout). Also when the central processing unit of the mini-computer was down, the total system would be out of operation and the terminal operators would not be able to use the system. In the case of a combined system downtime events were expected to occur more frequently than for each one of the separate systems. This was due to the greater demands made on the system by the combined operations (greater number of disc

accesses, interrupts, etc. for the combined system).

If backup and recovery procedures involved many files, as would be the case if the two divisions would operate a combined system, then the risk of operator errors as well as the time required to handle backup and recovery functions increased. Priority considerations, such as "Which division's files should be restored first?" may have been difficult to resolve to both divisions' satisfaction.

The only difference in staffing a combined system as compared with two separate systems related to the operation manager's job. Under separate systems, the manager would also do maintenance programming, while this function would have to have been assigned to a separate programmer under a combined system. The total number of staff required for two separate systems was equal to the total number of staff required for the combined system.

In this case, the communication and terminal costs for a combined system were equal to the sum of these costs for the two separate systems. However, a combined system would approach the capacity limitations of one mini-computer. In the case of the HP-2100 mini-computer, the capacity loading of the following critical components under combined systems was:

1	Terminals	85%
2	Disc file space	80%
3	Core memory	100%

Separate systems would allow additional applications to be added at each division (e.g. order-entry in the case of Corrugated Containers, production scheduling in the case of Converted Papers). A combined system, on the other hand, would be "filled up" from the very start. If the applications to be added were closely related to the range of applications presently planned it may then have become desirable to make room for these applications by moving the applications of the other division to another system. Such a conversion effort, which appeared to be a very likely event in the case of a combined system, could easily have exceeded the remaining dollar advantage of its lower hardware cost.

The project team concluded that the economies of scale attributed to large-scale computers were in dispute in this specific case, which dealt with a mini-computer

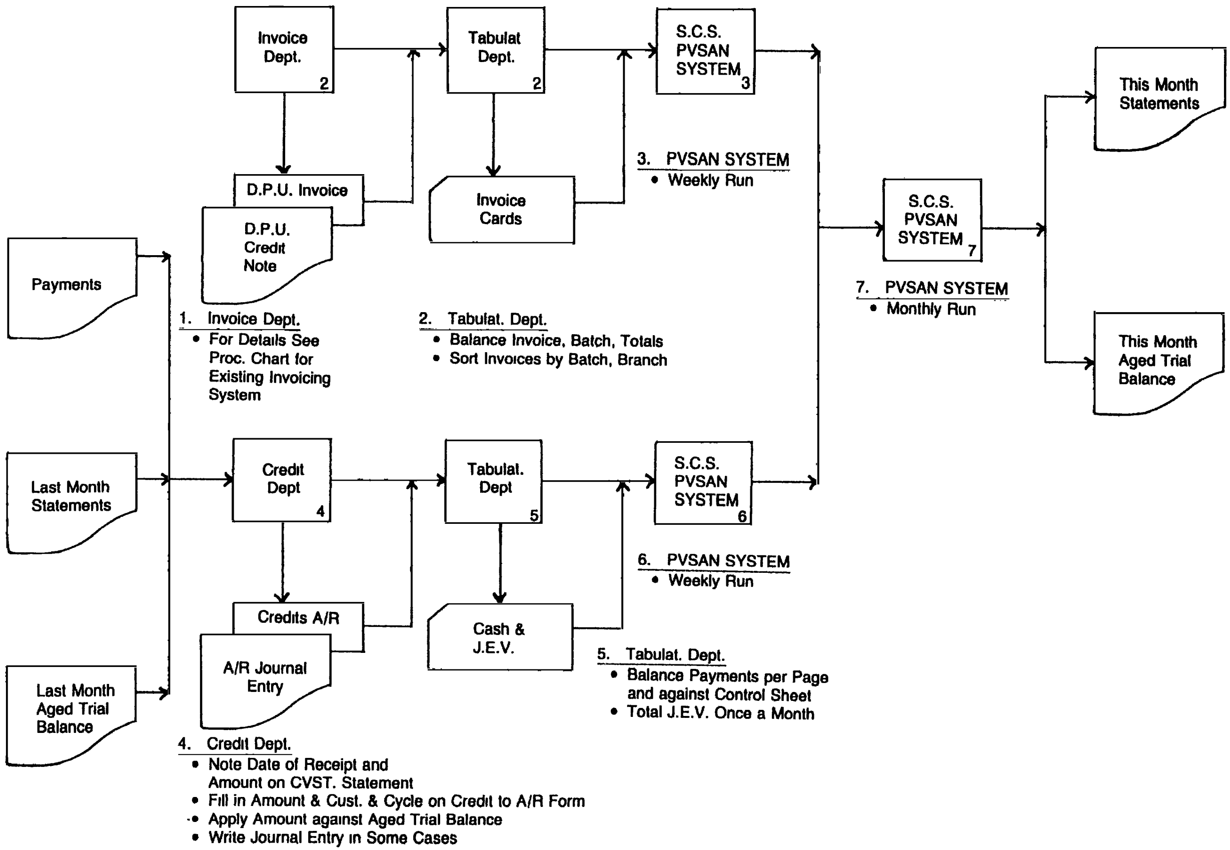
system. There existed now a great deal of data supporting the view that mini-computers were most effective if limited to a small range of closely related applications.

The team concluded their report with a detailed cost justification of the multi-terminal mini-computer system (briefly summarized in Appendix B). At this time the team was trying to determine what, if anything, they could do to increase the probability of a successful appraisal of their RSI.

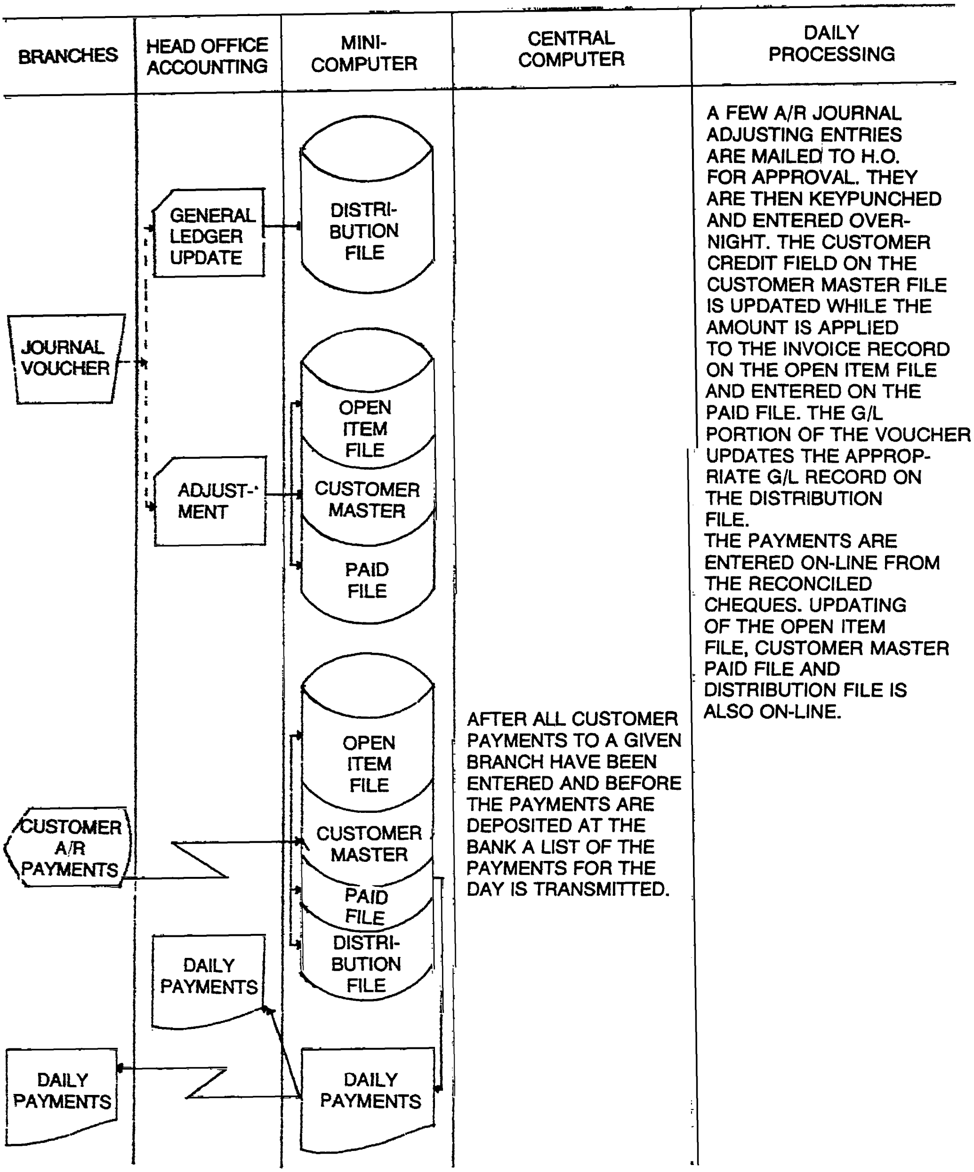
APPENDIX A

DOMTAR PACKAGING LIMITED

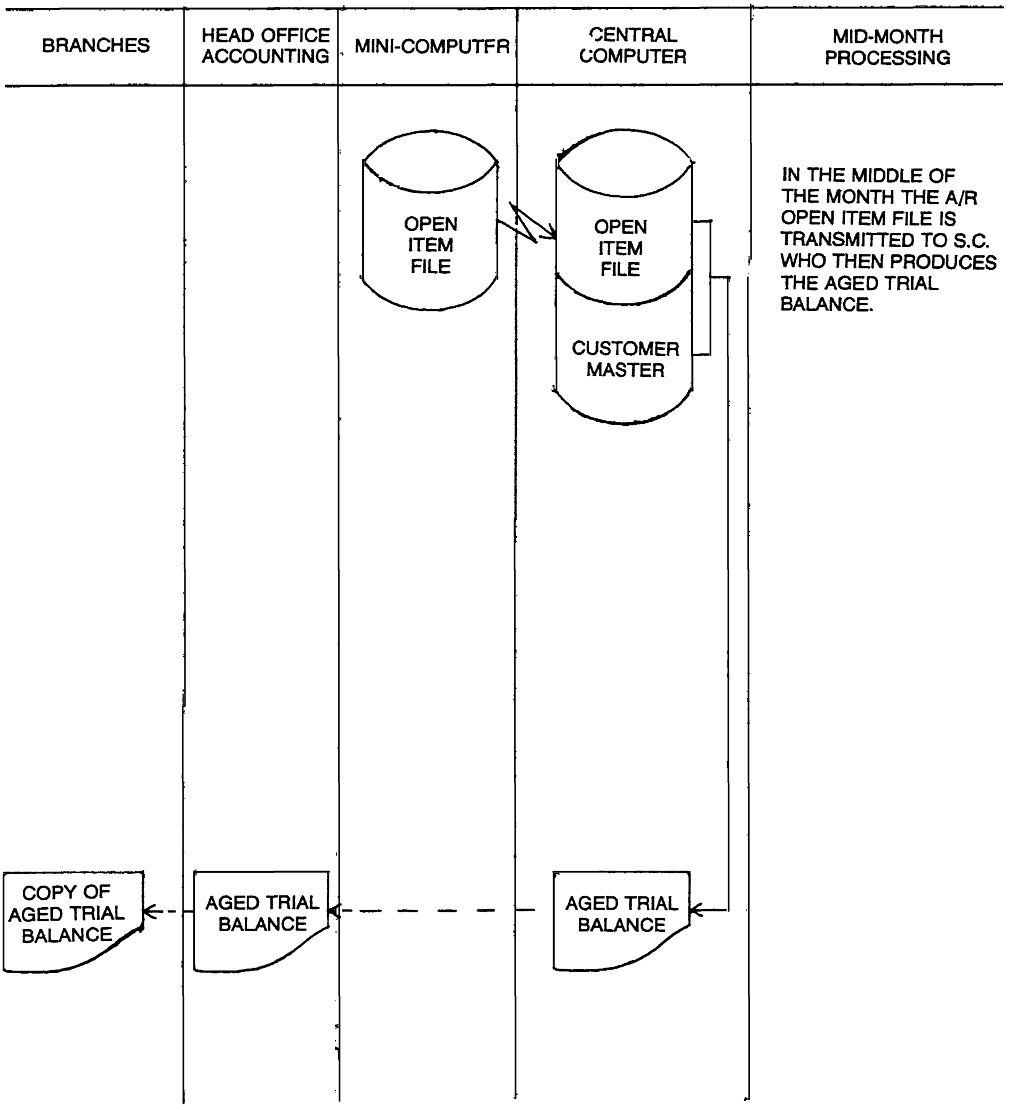
Converted Papers Division, Existing Accounts Receivable System



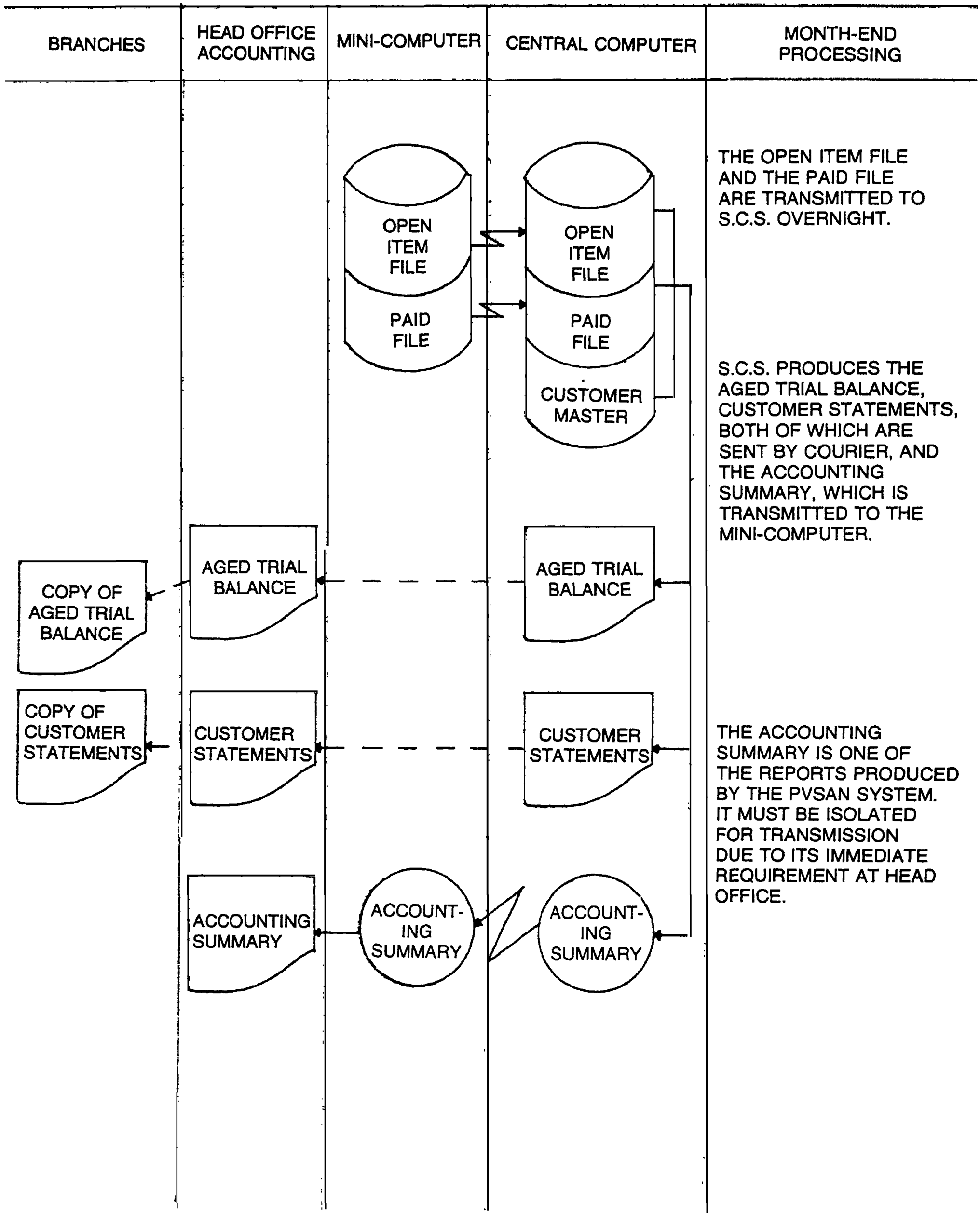
DOMTAR PACKAGING LIMITED
Converted Papers Division,
Accounts Receivable Application



DOMTAR PACKAGING LIMITED
Converted Papers Division,
Accounts Receivable Application (Continued)



DOMTAR PACKAGING LIMITED
Converted Papers Division,
Accounts Receivable Application (Continued)



APPENDIX B:
Justification of the Multi-Terminal
Mini-Computer System

1 SAVINGS

The efficiency of the proposed system, which was hopefully conveyed in the review of the general processing logic, would bring significant savings to the corporation:

a Staff Savings

The greater speed and the greater accuracy of the computer-assisted operations at the branches, such as invoicing, pricing, customer payment application, and the elimination of inventory posting and purchase order preparation would bring about staff reductions at most branches.

At division head-office, the elimination of key-punching, key-verification and balancing functions would be partially offset by additional staff to man the centralized inventory control department and the mini-computer facility at Toronto. One new pricing clerk would be required at division head-office to monitor and control the revision and updating of the central pricing file.

The net staff savings are tabulated below. Details are shown in Exhibit 1 of the Appendix.

	Staff reduction	Staff savings
Branches	11 1/2	$ 83,300
Head office	4	8,200
Overtime & vacation replacement costs		3,206
Fringe benefits @ 15 1/2 on $91,580		14,195
	15 1/2	$108,981

b Working Capital Savings

Working capital savings would be achieved by the new system in two areas:

- Inventory investment
- Accounts receivable investment

As far as inventory investment was concerned, reduced lead-times through the automatic reordering facility of the system and the greater degree of central control over inventories was expected to result in inventory reduction at the branch warehouses as follows:

Atlantic Region	$ 74,000
Quebec Region	194,000
Ontario Region	160,000
Western Region	46,000
	$474,000

If we applied the combined handling and carrying costs of 15% to the investment reduction of $474,000 this would result in saving of $71,000/annum.

In the area of accounts receivable investment, the automatic credit checking of every order prior to shipment would prevent credit being extended beyond reasonable time and dollar limits. This was expected to reduce investment locked up in overdue accounts by approximately $60,000. At an interest cost of 10%, this would produce savings of $6,000/annum.

c Adherence to Approved Pricing as Dictated by the System

The use of only approved prices by the system would eliminate unapproved price deviations by salesmen and internal sales clerks. Pricing errors would also be eliminated. Since the pricing file would be maintained by one authorized person at division head-office, control of prices under the new system would be very effective. Prior spot-checks indicated that the division could expect to improve profits through accurate pricing by a minimum of $60,000/annum (this represented 0.162% of 1974 forecasted annual sales revenue of $37,000,000).

d Savings in Mail, TWX and Telephone Costs

Since the new system placed the responsibility for data-entry and correction with the user at the branches and allowed immediate corrections, no mailing of batches of source-documents (excepting accounts payable) would be required. Furthermore, the current need for telephone calls and TWX messages between the data-entry department and the branches for the purpose of correcting errors would be fully eliminated. The system would also allow urgent messages, which in the past were sent via TWX, to be sent directly through the system's network. The overall effect of these changes was expected to produce additional savings of $5,000/annum.

e Savings Due to Elimination of Data-Entry Department

The new system would assume the functions of the existing data-entry department, which was located at Mullins Street in Montreal. Since most of the input-keying would take place at the branch terminals under the new system, all but two keypunch-keyverify stations could be eliminated. The remaining stations would be used for master-file maintenance and for the input-keying function of the accounts payable application.

Savings would be as follows:

	$/Annum
Existing unit-record hardware cost (rental)	$16,548
Deduct:	
Keypunch-keyverify stations to be retained	
2 IBM 129 @ $2,324/annum	4,648
Net savings	$11,900

2 NEW COSTS

The savings outlined on the preceding pages would be partly offset by the costs of lines and terminals.

a Terminal Costs

The communications network would use 12 Burroughs

TC500 terminals and 1 Hewlett-Packard video-screen (CRT). The cost of the video-screen was incurred with the mini-computer equipment to be purchased. The annual rental cost of Burroughs terminals was $58,116. (See page 253 of this Appendix.)

b Costs of Lines and Datasets

The lines and datasets which link the mini-computer to the respective branch-terminals and to the central computer would cost $27,348 per annum. (See page 253 of this Appendix.)

c Additional Processing Costs for New Applications at the Central Computer

The new system would mean increased processing at the central computer. The applications affected are accounts receivable, inventory control, accounts payable and general ledger. As a result, approximately 20 hours of processing per month were added to the existing 27 hours of central computer time. The annual cost of this extra processing was $20,400 (20 x $85 x 12 = $20,400).

d Maintenance Service Costs for Mini-Computer System

Annual maintenance service costs of the mini-computer and its peripherals amounted to $9,200 per annum.

3 SUMMARY OF SAVINGS AND NEW COSTS

Recapping the savings and the partially offsetting costs, the following summary results:

Savings per Annum		
1. Staff savings	$108,981	
2. Savings through reduction in working-capital		
- In inventories	71,000	
- In accounts receivable	6,000	
3. Savings from elimination of unapproved price-deviations, pricing errors	60,000	
4. Savings in mail, TWX, & telephone costs	5,000	
5. Savings from elimination of unit record equipment	11,900	$263,881

New Costs per Annum		
1. Cost of terminals	$ 58,116	
2. Cost of lines & datasets	27,348	
3. Additional processing costs at central computer	20,400	
4. Maintenance service contract costs for mini-computer equipment	9,220	$115,084
Net savings		$147,797

4 CASH FLOW REPRESENTATION AND RATE OF RETURN

The cost of the mini-computer and its peripherals was $150,000 (see Exhibit 2 of this Appendix). Its economic life was estimated at 8 years. Implementation costs[1] were estimated at $220,000 (see Exhibit 3 of this Appendix). From these details and the preceding summary of savings, the cash flows as they pertain to the life of project were as follows:

Cash Flow in $ Thousands

Year	Taxable receipts[2]	C.C.A.	Tax (at 44%)	After tax receipts	Capital expend.	Net cash
1	-220.0	30.0	-110.0	-110.0	150.0	-260.0
2	148.0	24.0	54.6	93.4		93.4
3	157.0	19.2	60.6	96.4		96.4
4	167.0	15.4	66.7	100.3		100.3
5	177.0	12.3	72.5	104.5		104.5
6	187.0	9.8	78.0	109.0		109.0
7	199.0	7.9	84.1	114.9		114.9
8	212.0	6.3	90.5	121.5		121.5

Based on the above cash-flows, the rate of return is 26.6%. The payback period is 3.7 years.

[1]Implementation costs--see details in Exhibit 3 of this Appendix.

[2]Increase in taxable receipts from years 3-8 was caused by application of 8% yearly increase in the net staff savings generated.

At the present time, two types of terminals were still under consideration. One is the GE Terminet 300 which would be rented from Bell Canada or CN/CP and the second is a stripped version of the Burroughs TC500. Using either one of these two terminals will not impact heavily on project cost, as shown in the table on page 253.

	Using TC500			Using Terminet 300		
	Line speed	Line cost/mark	Terminal cost/mark	Line speed	Line cost/mark	Terminal cost/mark
Halifax, N.S. also handles Sydney's data	150	$ 133	$ 345	300	$ 222	$ 325
St. John, N.B.	300	197	345	300	197	325
Montreal, Que.[3]	600+300	352	1035	300+300+300	375	975
Ottawa, Ont.	300	121	345	300	121	325
Toronto, Ont.[2]	3 local loops 6 modems	212	690	3 local loops 6 modems	212	650
London, Ont.	300	100	345	300	100	325
Sudbury, Ont. also handles Timmins data	300	120	345	300	120	325
Winnipeg, Man. also handles Thunder Bay's data	150	133	345	300	223	325
Saskatoon, Sask.	150	158	345	300	264	325
Montreal, Queb.	2400	703	345	2400	703	325
Total/Month		2229	4140		2537	3900
Contingency = 1 extra terminal			345			325
tax		50	358		57	338
Total/Month		2279	4843		2594	4563
Total/Year		27348	58116		31128	54756
Total Net Work/Year		85,464			85,884	

Exhibit 1

DOMTAR PACKAGING LIMITED

Summary of Staff Savings,

Positions Added or Reduced

Locations	Inventory clerk @ $8100/yr	Invoicing clerk @ $7320/yr	Clerk typist @ $6000/yr	Order desk clerk @ $8100/yr	Terminal Operator @ $8100/yr	Net saving per year
St. Johns, N.B.	-1	-1	-1		+1	13,320
Halifax, N.S.	-1	-1			+1	7,320
Montreal, P.Q.	-2	-3			+2	21,960
Ottawa, Ont.	-1			-1	+1	8,100
Toronto, Ont.	-2	-3			+2	21,960
Sudbury, Ont.	-1				+1	NIL
London, Ont.	-1	-1			+1	7,320
Timmins, Ont.	NO CHANGES					NIL
Thunder Bay, Ont.	NO CHANGES					NIL
Winnipeg, Man.	-1	-1			+1	7,320
Saskatoon, Sask.					+1/2	-4,000
Head Office						
Toronto, Ont.					+2	-16,200
						67,100

Other Head Office	Reduction,	Salary	Additions,	Salary	
Supervisor	2	19,200	2	31,000	-11,800
Unit Record Operator	1	8,100			8,100
Keypunch Operator	7	48,760	1	6,000	42,760
Programmer			1	14,000	-14,000
Computer Operator			1	10,000	-10,000
Clerk Typist	1	7,320	1	6,000	1,320
Data Control Clerk	1	8,100			8,100
					91,580
		Add Overtime, Fringe Benefits, etc.			17,401
			Net Savings 2nd year		108,981

Add 8% for each of the next six years to represent annual increase in salary and benefits.

Exhibit 2

DOMTAR PACKAGING LIMITED

Mini-Computer Description and Cost

Hewlett-Packard 2100 System	
24k words of main memory 5.4 megabytes of disc storage 1600 BPI tape drive 30 CPS terminal printer Paper tape reader 2 cabinets Disc operating system III Image file management package	$ 63,122
Multiplexor--16 ports	4,451
8k extra memory	2,340
Second disc drive--15 megabytes	16,000
CRT Terminal; character-mode	3,800
Card reader	4,618
Line printer 200 LPM	15,980
Data communications card (re central computer)	819
Data communications software	1,556
I/O extender	4,505
Miscellaneous other items (cables, etc.)	2,000
Extra cabinet	2,500
	121,691
10% F.S.T.	12,169
7% P.S.T. Ontario	9,370
Contingency (5% of purchase value)	6,770
	$150,000

Exhibit 3
DOMTAR PACKAGING LIMITED
Implementation Costs*

1.	Systems Decision		
	30 weeks @ $490 per week	$14,700	
2.	Programming		
	a) Hewlett-Packard mini-computer:		
	23 batch-programmes at 2 week/programme = 46 wks		
	18 on-line programmes at 3 weeks/programme = 54 wks		
	41 — 100 wks		
	@ $490/week	49,000	
	b) Burroughs TC500 terminal		
	15 programmes @ 1.5 weeks/programme = 22.5 wks at $490/wk	11,000	
	c) Central Computer		
	Accounts Receivable		
	3 programmes @ 4 wks/programme		
	12 wks at $700/wk	8,400	
	Inventory Control		
	3 programmes @ 4 wks/programme		
	12 wks at $700/wk	8,400	
	Accounts Payable		
	Modify package 2 wks at $700/wk	1,400	
	General Ledger		
	Modify package 3 wks at $700/wk	2,100	
	Our Share of Cost of Accounts Payable, 1/3 or $75,000	20,300	
	General Ledger Packages	25,000	
	d) Programming Contingency	40,000	
	e) Computer time at SCS for programming and testing	15,000	$160,000

*Implementation Costs do not include the costs of preparing the documentation that precedes approval, since these costs are already incurred and not recoverable if approval is not obtained.

Exhibit 3

DOMTAR PACKAGING LIMITED

Implementation Costs (Continued)

3.	Other Implementation Costs		
	a) Clerical help during file creation 10 mths @ $800	8,000	
	b) Recruiting, termination, & relocation costs	8,000	
	c) Education of systems analysts & programmers (4)	11,750	
	d) Travelling Costs of systems analysts between locations	7,000	
	e) Cost of Site Preparation in Toronto	5,000	
	f) Cost of Operator Training (salaries & travelling)	4,000	
	g) Cost of Installation of Communication Lines	1,200	45,000
	TOTAL IMPLEMENTATION COSTS		$220,000

The Guaranteed Student Loan Program

Balaji S. Chakravarthy

In the summer of 1975 the Office of Education (OE) in the Department of Health, Education, and Welfare (HEW) was faced with a number of complex problems surrounding its controversial Guaranteed Student Loan Program (GSLP) and was contemplating how to respond to them.

The first problem centered on formulating an appropriate response to the legislation introduced by Cong. James O'Hara (D. Michigan) which would amend the existing legislation by phasing out the Federal Loan Insurance program and by prohibiting colleges and other nonfinancial institutions from floating student loans under the provisions of the program. In the words of Cong. O'Hara, this provision was akin in spirit to a sign in a pizza parlor, not far from the House:

> We have an agreement with the bank. We won't cash checks, if they won't sell pizzas.

The second problem centered on the desirability and feasibility of implementing a new information system for the program. Since its inception, the program had been plagued by inadequate record-keeping systems, leading to widespread charges of inability to properly control the program and to prevent fraud and inefficiency. It was hoped that the new system would ameliorate this problem, but the failure of previous attempts to install such a system did not bode well for the future.

These problems are made all the more urgent by a spate of recent articles which publicized the administrative short-comings of the program. On June 30 of 1975, for example, the lead article of the Wall Street Journal was headlined:

> Costly Lesson,--Charges of Fraud Hit Student-Loan Program Backed by Government....--Proprietary Schools,

Banks Investigated by Agencies; Students Among Victims....--Bigger than Billie Sol Estes?[1]

LEGISLATIVE HISTORY

The origin of the legislations establishing the program is not very clear. It is believed that the legislations were proposed as a substitute for the "education write-off" bill proposed by Abraham Ribicoff. The Ribicoff legislation would have permitted parents to deduct some portion of their expenses for their children's post-secondary education in computing their income-tax liabilities. The Ribicoff proposal would have meant a severe drain on federal tax revenues. Instead, two acts for assisting the student loan insurance program were proposed. It was believed that by encouraging liberal availability of low cost loans to students, the aim of removing barriers to post-secondary education would be achieved, at a lower cost to the federal government.

The Higher Education Act of 1965 (HEA) and the National Vocational Student Loan Insurance Act of 1965 (NVSLIA) were enacted to encourage the states and private nonprofit institutions and organizations to establish adequate student-loan insurance programs in eligible institutions. These legislations were substantially different from most of the acts then administered by the Office of Education (OE). The OE was used to a system of direct grants to deserving students. The new legislations required the OE to support student loan insurances of state and other nonprofit agencies. The OE had little of the financial or administrative experience required by the new legislations.

At the time of the 1965 enactments, 17 states had independent state agencies which administered student loan insurance programs at the state level. After the enactment and the ensuing appropriations, 6 additional states either created or designated an official state agency to operate a student loan insurance program at the state level.

[1]In the 1960s, Billie Sol Estes, a Texan, sold finance companies \$24 million of mortgages on nonexistent fertilizer tanks. A federal law-enforcement official is quoted by the paper to have stated that the student loan scandal "is going to be bigger than that."

Twelve other states contracted with United States Aid Funds, Inc. (USAF), a nonprofit agency, to carry out such a program. The federal government, through the Office of Education, contracted with the USAF to administer a program at the state level in the 15 remaining states that took no action of their own. The Office of Education, which was given the responsibility of administering the Guaranteed Student Loan Program, was required to induce greater availability of student loans through its financial support to guarantee agencies. The OE was also directed to provide interest subsidies to deserving students and thus reduce the cost of loans to such needy students.

The demand for student loans soon exceeded the amount of state and/or federal funds available for insuring loans at the state level. A Federal Insured Student Loans Program was hence started. The federal program, which was authorized under HEA and NVSLIA, was first used in August 1967. In most cases, the initiation of the federal program within a state was requested by the governor of that state. The purpose of the federal program was to help students or lenders who did not have reasonable access to a state or nonprofit program of student loan insurance.

During 1968, Public Laws 90-460 and 90-575 were enacted to be operational in fiscal year 1969. This legislation repealed the NVSLIA and amended HEA to include students in vocational schools covered by the former act. In addition, Section 428 of HEA was amended to provide for federal reinsurance of loans guaranteed by state and private agencies. The purpose of introducing reinsurance was to increase the guarantee capacity of such agencies. This amendment authorized the Office of Education to enter into agreements with state and private guarantee agencies, whereby such guarantee agencies would be reimbursed for 80% of their losses resulting from students' default of loans or to the non-payment of loans that had been made prior to December 15, 1968, due to death or permanent disability of a student borrower. Losses resulting from the death or permanent disability of a student borrower on a loan made on or after December 15, 1968, were not covered by reinsurance. For such a loan, the legislation provided that OE would pay the entire amount owed on a loan by a student borrower who dies or is permanently disabled, regardless of the source of guarantee (state or private) and regardless of whether or not the guarantee agency had signed a reinsurance agreement.

In order to provide low interest loans to students, the various acts and their amendments had provided for partial payment by OE on behalf of qualified students of the interest charged by lending institutions on loans insured under the federal program, or reinsured by the OE. The qualification was based on students' family income, computed on a specified basis. For students who did not qualify, the maximum interest chargeable by a lender was fixed at 7% on the unpaid principal balance of the loan.

With changing economic and money market conditions, it was felt that a 7% interest rate would not be attractive to lenders to sustain and expand loans to students. However, a rate of more than 7% would hurt student borrowers severely. To provide an incentive to lenders, the Commissioner of Education was authorized to pay a special allowance to lenders, so as to provide them an equitable return on their loan holdings. The authorization was granted under the Emergency Insured Student Loan Act of 1969. Thus lenders received up to 3% more than the stipulated 7% on their loans to students.

In 1972, the Congress enacted PL-92-318, paving the way for the creation of Sallie Mae (the Student Loan Marketing Association). Student loans were frozen on a lender's books for the length of their maturity, since there was no established market in which to turn these notes into cash. In tight money situations, lenders had to set a ceiling on the amount of funds allocated to guranteed student loans. Sallie Mae introduced a program of warehousing advances, and a loan purchase program, to provide liquidity to student loans. Sallie Mae is a government-sponsored private for-profit corporation.

THE GSLP OPERATION

The program operations involve three key terms which need further description:

(1) A student is eligible to borrow under the program if he is a U.S. citizen or permanent resident and is enrolled at least half time in an eligible institution and is in good standing in his school.

(2) An eligible institution has been defined in detail in Sec. 435 of the HE Act of 1965, as amended. Broadly it includes an institution of higher education (i.e. provides education beyond secondary education), a vocational school and with respect to students who are U.S. nationals, an

institution outside the U.S. which is comparable to an institution of higher education or to a vocational school in the U.S., and which has been approved by the Commissioner of Education.

(3) A loan is determined to be in default when one of the following events occur:

1 The borrower fails to make an installment payment when due for 120 days in the case of a loan repayable in monthly installments or for 180 days in the case of a loan repayable in less frequent installments.

2 The borrower is adjudicated as bankrupt.

3 The borrower dies or becomes totally and permanently disabled.

The operation of the program is best described by a set of flow diagrams. Exhibit 1 shows the general process flow, describing the whole program. Exhibit 2 (Present System) details out the sequence of activities to be followed by the student to obtain a loan. The application phase is further amplified in Exhibit 3 (Present System). Exhibits 4 and 5 (Present Systems) describe the in-school, in-grace and repayment/default phases of the program.

FINANCING THE PROGRAM

The insurance and reinsurance of loans undertaken under the GSLP are funded by the Student Loan Insurance Fund (SLIF). The fund is open-ended and financed by direct appropriations from the Congress, insurance premiums collected from participating lenders (only on loans made under the federal program), and proceeds from the collection of defaulted loans. The premium is computed at 1/4 of 1% a year, on the unpaid principal amount of a loan, from the date of disbursement of the loan to the student borrower to the anticipated date of his or her graduation plus 12 months. The entire premium is collected in advance.

Repayment of the loan is over a period of not less than 5 nor more than 10 years beginning not earlier than 9 nor more than 12 months following the date on which a student ceases to be enrolled on at least a half-time basis at an eligible institution. However, as the act requires the student to repay at a rate of not less than $360 a year, the actual repayment terms will depend on the student's total indebtedness. Principal payments need not be made by the

Exhibit 1
THE GUARANTEED STUDENT LOAN PROGRAM
General Process Flow

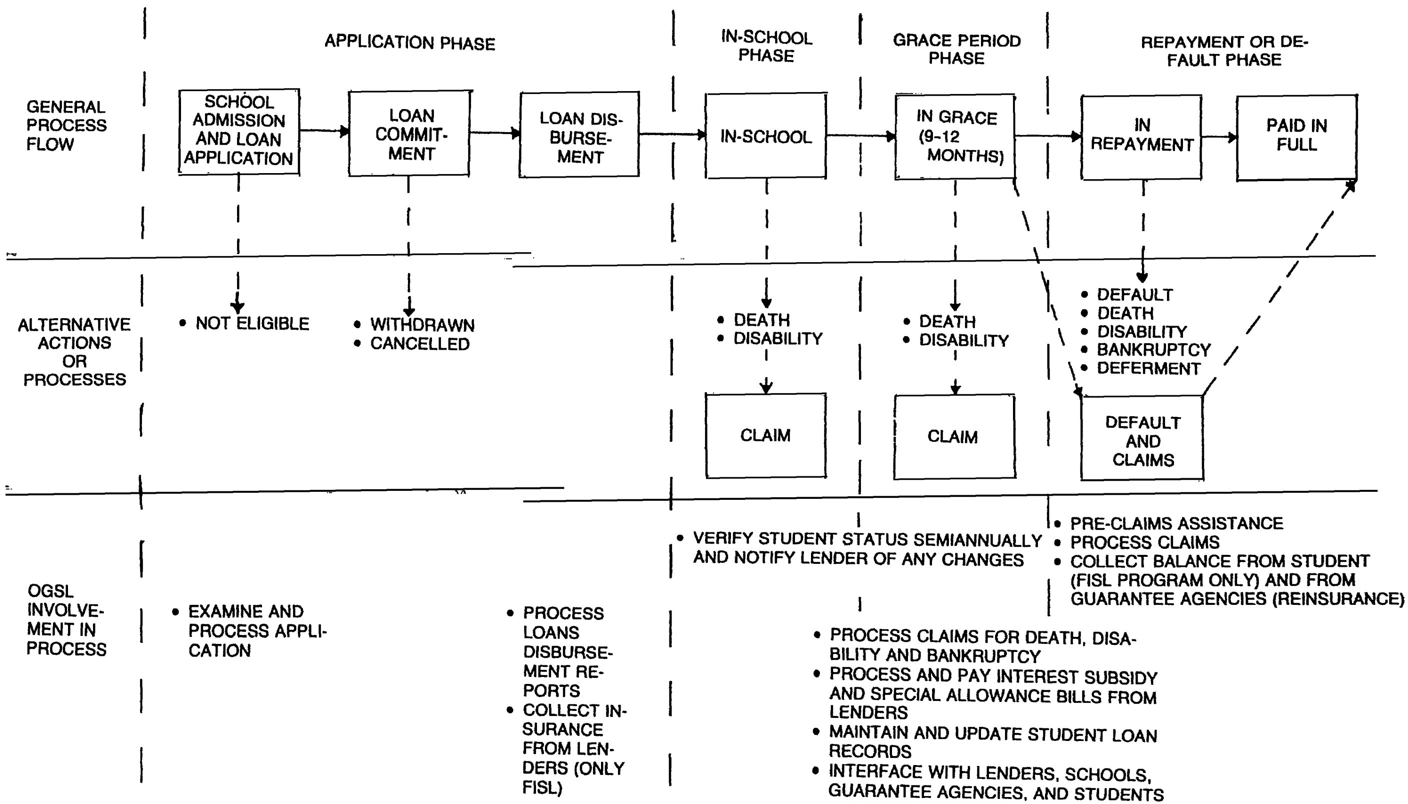
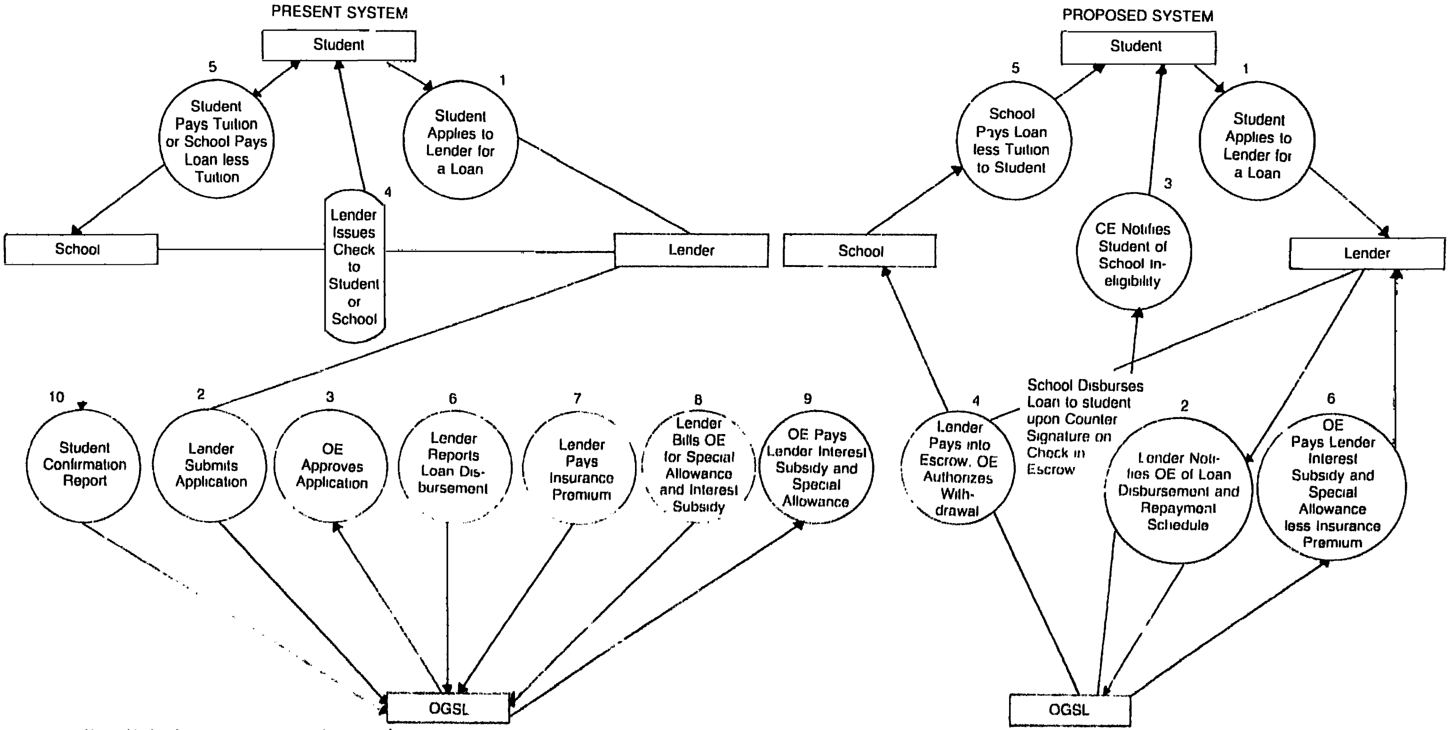


Exhibit 2

THE GUARANTEED STUDENT LOAN PROGRAM

Functional Process Flows

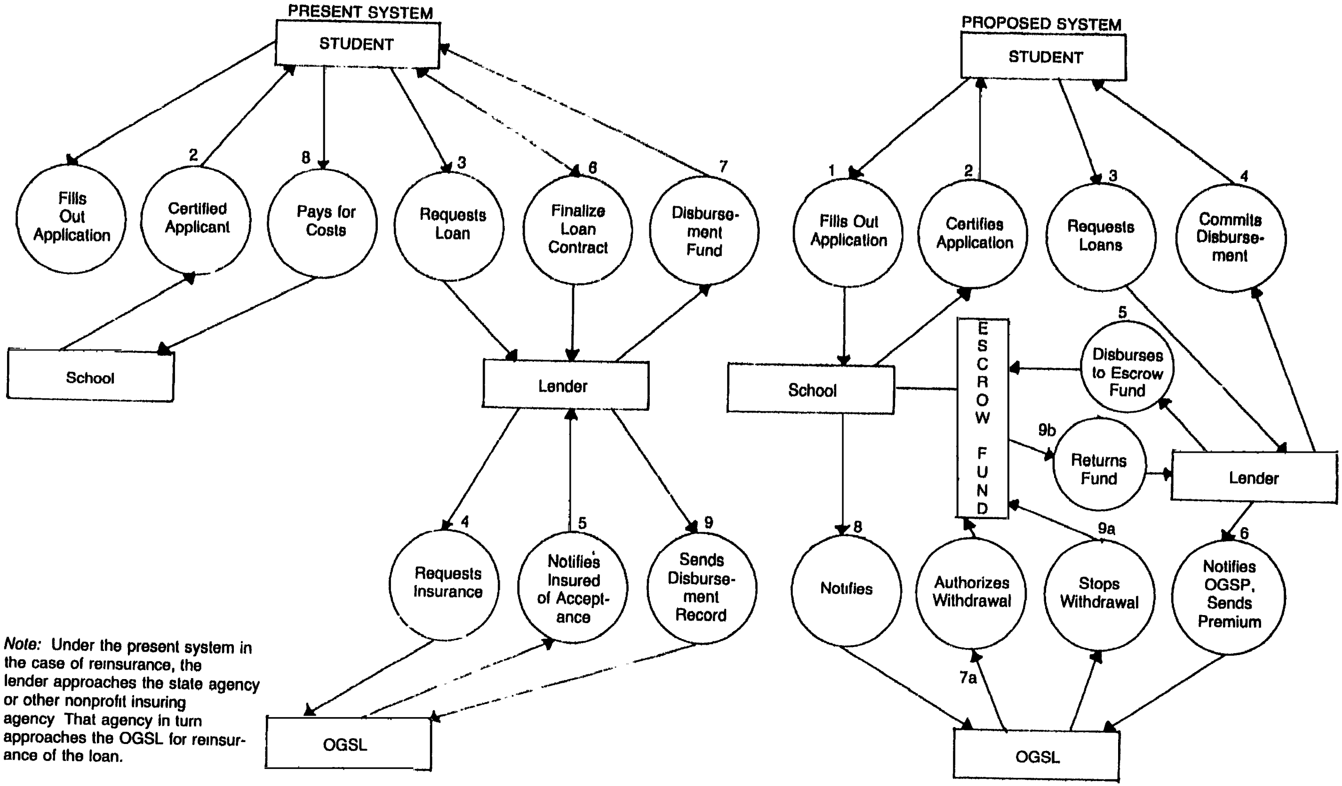


Note. Under the present system in the case of reinsurance of loans, the state agency or concerned nonprofit guaranteeing agency approaches the OGSL in a manner similar to what the lender does under the FISL system, except for activity 7 which is not required for reinsured loans

Note. The following information is required to automatically pay interest.
- Date of disbursement
- Amount of disbursement
- Date converted to repayment
- Average balance remaining during the quarter

OE automatically calculates insurance premium, interest subsidy, and special allowance

Exhibit 3
THE GUARANTEED STUDENT LOAN PROGRAM
Loan Application Process



Note: Under the present system in the case of reinsurance, the lender approaches the state agency or other nonprofit insuring agency. That agency in turn approaches the OGSL for reinsurance of the loan.

Exhibit 4
THE GUARANTEED STUDENT LOAN PROGRAM
In-School and In-Grace Processes

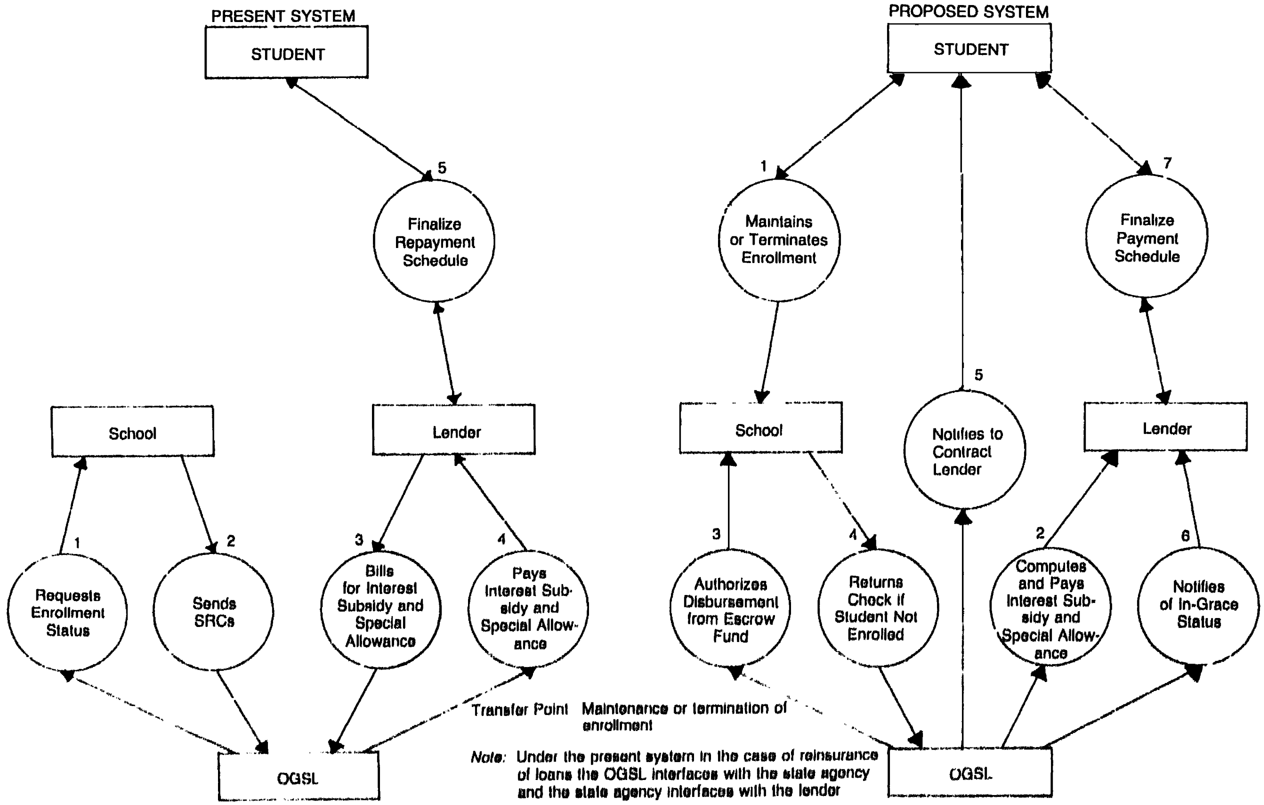
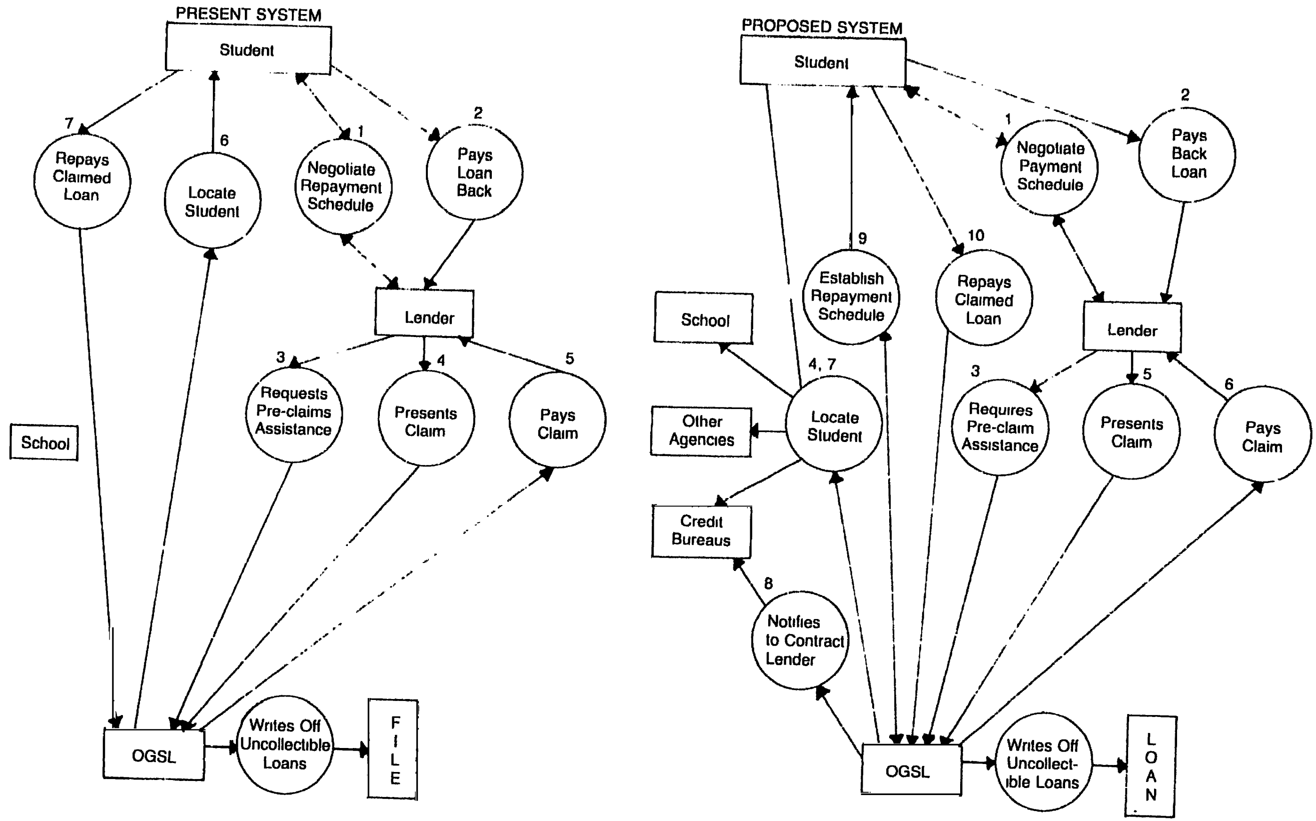


Exhibit 5
THE GUARANTEED STUDENT LOAN PROGRAM
Repayment and Claims Processes



borrower for up to 3 years while he is a member of the Armed Forces, a volunteer in the Peace Corps or VISTA or for any period during which the student is pursuing a full-time course of study at an eligible school.

Payments of interest expenses on behalf of eligible students, as well as the salary and office administration expenses under the program, are funded by separate provisions. Death and permanent disability claims on loans insured after December 15, 1968, are also funded by sources external to the SLIF.

ADMINISTRATION OF THE PROGRAM

In the initial stages, the program was administered as a branch within the Bureau of Post-Secondary Education in the Office of Education in the Department of Health, Education, and Welfare. As the program grew explosively, the branch was upgraded to a division and finally into the Office of Guaranteed Student Loans (OGSL). In addition the program was transferred from the Bureau of Post-Secondary Education to the Office of Management. The present position of OGSL within the Office of the Commissioner of Education is shown in Exhibit 6. The current internal organization of OGSL showing the important branches is as per Exhibit 7.

In the early stages of the program, it was administered largely by persons who had worked in the insurance programs of the Federal Housing Agency (FHA).

Given its legislative antecedents, the staff of the program viewed its primary mission as the maximization of loan volume. In order to accomplish this goal they spent a large amount of time establishing contacts with the financial community. They felt that this task was vital to the success of the program but difficult to implement. The difficulties arose because the OE had no history of involvement with the financial community and because the 7% interest rate was felt to be low (and, by some, inadequate) compensation to the banks.

In the early 1970s, the program administration passed on to a person with experience in commercial credit and student loan administration. While most of the program staff from the previous administration was retained, the program stepped up its recruitment from 1972 onwards. As of 1975 the program, which had then acquired the status of an office, had nearly 500 employees at the head office and its ten regional offices.

Exhibit 6

THE GUARANTEED STUDENT LOAN PROGRAM

The Office of the Guaranteed Student Loans, in the Office of the Commissioner of Education

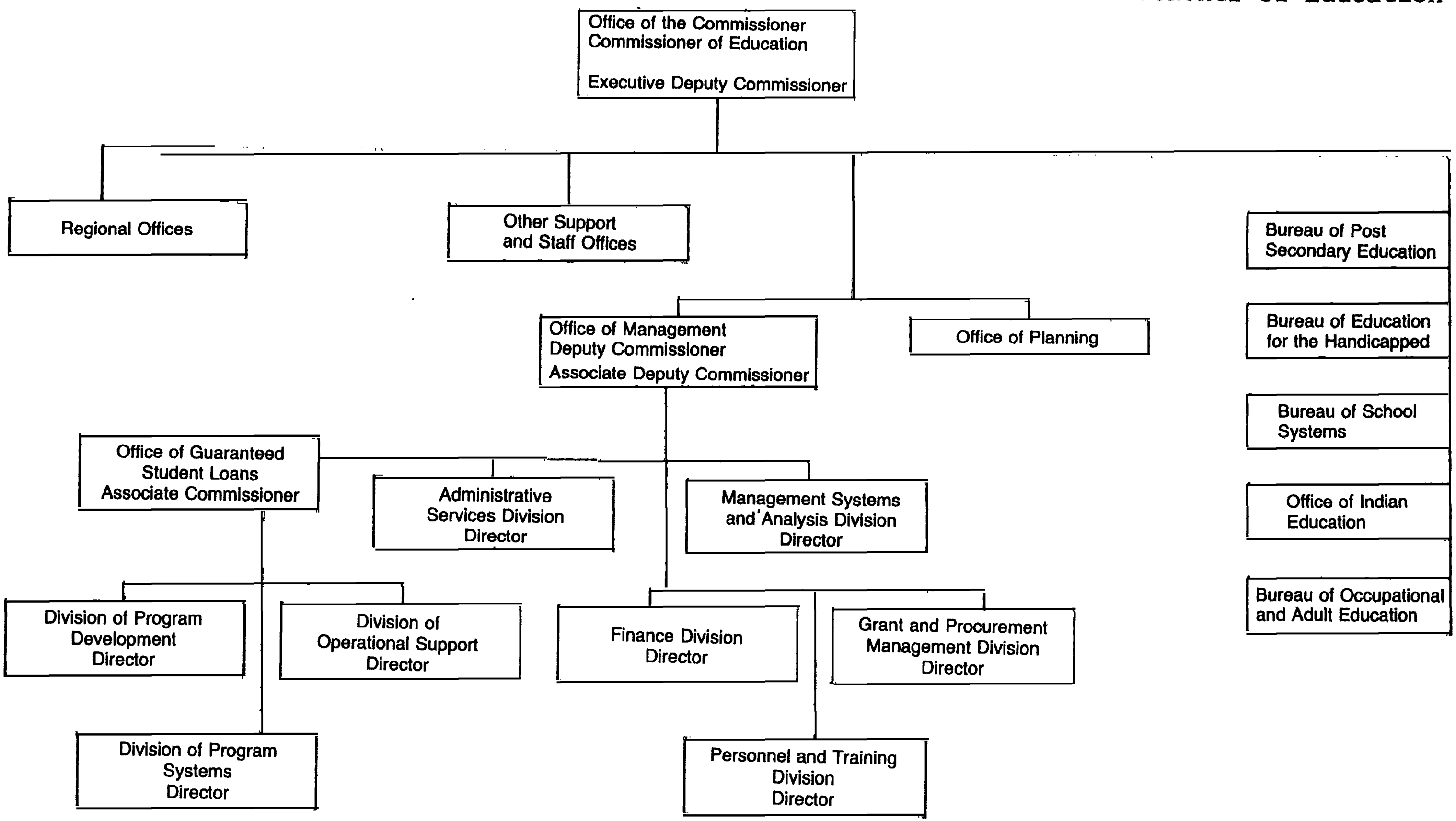
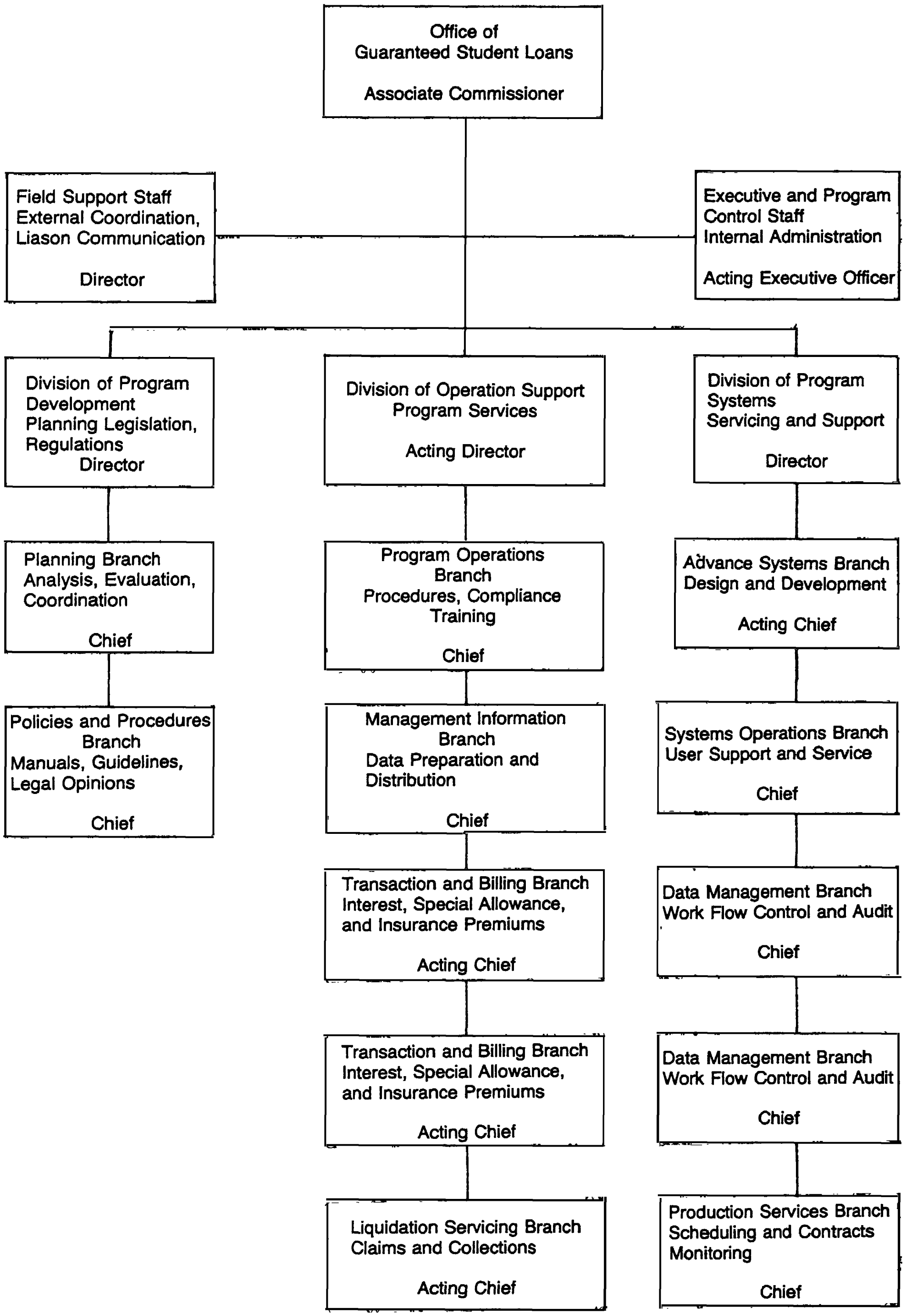


Exhibit 7

THE GUARANTEED STUDENT LOAN PROGRAM

Organization Chart, Office of Guaranteed Student Loans



One of the significant reorganizations made concurrent with the growth in staff strength was the creation of a full-fledged Division of Program Systems, with its own complement of programmers and system analysts. The division was headed by a director, an officer transferred from the Cost of Living Council. The Director of the Division of Program Systems had previously worked under the OE's present Deputy Commissioner of Management while both were employed at the Cost of Living Council.

PROGRAM STATISTICS AS OF 1975

The annual loan volume under the program grew rapidly from a total of 48,495 loans at $77.49 million in 1966 to a total of 937,527 loans at $1.14 billion in 1974. The cumulative loan volume in the period had grown to $6.97 billion. Exhibit 8 shows the details of yearly growth in loan volume. Exhibit 9 gives some select data on the interest subsidies paid, special allowances granted, premiums collected and default claims paid under the program as of the third quarter of 1975.

PERFORMANCE OF THE PROGRAM

As described earlier, the major funding for the program comes from the Student Loan Insurance Fund (SLIF). The SLIF is audited by the General Accounting Office annually. The SLIF financial statements for fiscal year 1974 are shown in Exhibits 10 and 11. The GAO had been critical of the SLIF accounting ever since the first statements were prepared in 1968.[1]

Most of the GAO Audit Staff and the officers of the OGSL identified three broad sets of management problems.

1 Policy issues: The financial performance of the program is dependent on the premium policy, which is the only charge levied by the program for its services. In the initial years of the program, the premium was fixed at 1/4 of 1%, largely based on the experiences of the officers of the OGSL, who were transferred from the Federal Housing Agency. The rate has not been subsequently revised since the office is not convinced that it has taken all steps to

[1]See GSLP (A) 9-175-244 and (B) 9-175-245, for a discussion of the program's financial accounting.

Exhibit 8

GUARANTEED STUDENT LOAN PROGRAM

Annual and Cumulative Commitments, Federal and Guarantee Agency Programs, Fiscal Years 1966-75

Fiscal year	Annual loan volume: Loan volume Number	Loan volume Amount	Share of total program Number	Share of total program Amount	Percent change Number	Percent change Amount	Average loan amount	Cumulative Number	Cumulative Amount
Federal program									
1966	--	--	--	--	--	--	--	--	--
1967	--	--	--	--	--	--	--	--	--
1968	82,549	66,555,455	16.0	15.3	--	--	$ 806	82,549	66,555,455
1969	248,491	217,606,700	31.6	31.7	--	--	875	331,040	284,162,155
1970	365,387	353,788,310	39.6	42.1	47.0	62.6	968	696,427	637,950,465
1971	481,691	484,014,989	45.1	46.4	33.3	36.8	993	1,178,118	1,121,965,454
1972	691,874	708,163,745	55.0	54.4	42.0	46.3	1,023	1,869,992	1,830,129,199
1973	599,085	654,615,799	55.0	54.6	-13.4	-7.6	1,092	2,469,077	2,484,744,998
1974	506,854	611,657,185	54.0	53.6	-15.4	-6.6	1,206	2,975,931	3,096,402,183
1975*	440,100	575,334,359	50.5	50.7			1,307	3,416,031	3,671,736,542
Guarantee agency									
1966	48,495	77,492,058	100.0	100.0	--	--	--	48,495	77,492,058
1967	330,088	248,494,327	100.0	100.0	--	--	752	378,583	325,986,385
1968	432,859	369,293,266	84.0	84.7	31.1	48.6	853	811,442	695,279,651
1969	538,854	469,069,081	68.4	68.3	24.5	27.0	870	1,350,296	1,164,348,732
1970	556,509	485,877,734	60.4	57.9	3.3	3.6	873	1,906,805	1,650,226,466
1971	594,151	560,034,714	54.9	53.6	6.8	15.3	942	2,500,956	2,210,261,178
1972	566,597	594,084,117	45.0	45.6	-4.6	6.1	1,048	3,067,553	2,804,345,295
1973	489,210	543,907,449	45.0	45.4	-13.7	-8.4	1,111	3,556,754	3,348,252,744
1974	430,673	527,776,266	46.0	46.4	-11.9	-2.9	1,225	3,987,427	3,876,029,010
1975*	430,810	559,880,707	49.5	49.3			1,300	4,418,237	4,435,909,717
Total program									
1966	48,495	77,492,058			--	--	--	48,495	77,492,058
1967	330,088	248,494,327			--	--	752	378,583	325,986,385
1968	515,408	435,848,721			56.1	75.4	845	893,991	761,835,106
1969	787,345	686,675,781			52.8	57.5	872	1,681,336	1,448,510,887
1970	921,896	839,666,044			17.1	22.3	910	2,603,232	2,288,176,931
1971	1,075,842	1,044,049,701			17.3	24.3	965	3,679,074	3,332,226,632
1972	1,258,471	1,302,247,862			16.4	24.7	1,034	4,937,545	4,634,474,494
1973	1,088,286	1,198,523,248			-13.5	-8.0	1,101	6,025,831	5,832,997,742
1974	937,527	1,139,433,451			-13.7	-4.8	1,215	6,963,358	6,972,431,193
1975*	870,910	1,135,215,066					1,303	7,834,268	8,107,646,259

*Preliminary--data based on oral figures--10 months

Note: Guarantee Agency figures under review and subject to change

Exhibit 9

GUARANTEED STUDENT LOAN PROGRAM

Selected Program Data, April 1975

Interest and special allowance total payments

Fiscal year	Interest	Special allowance
1967	$ 5,421,678	
1968	20,989,537	
1969	48,409,122	
1970	80,473,157	$ 4,954,823
1971	129,923,050	16,551,641
1972	171,707,845	18,123,333
1973	201,490,503	22,568,682
1974	218,972,466	82,369,373
1975 (thru third quarter)	148,082,569	91,260,062
Total	$1,025,469,927	$235,827,914

Cumulative claims summary[1]

	All claims paid Amount (000)	Default Amount (000)	Default Total	Bankruptcy Amount (000)	Bankruptcy Total	Death and disability Amount (000)	Death and disability Total
Federally Insured	$183,142	$168,550	92.0	$8,225	4.5	$6,367	3.5
Guarantee Agency	199,446	182,727	91.6	6,988	3.5	9,731	4.9
(Federally Reinsured)	120,530	109,784	91.1	3,570	3.0	7,176	5.9

Summary of collections

	Fiscal year 1974	Fiscal year 1975	Cumulative
Federally Insured	$4,192,071	$6,247,667	$13,700,289
Guarantee Agency--reinsured	3,347,851	3,230,665	9,719,890

Insurance premiums received

Month of April	Fiscal year 1975	Cumulative
$285,792	$2,820,716	$18,418,332

Lender participation

Type of lender (includes some branches)	Number	Percent of lenders	Eligible education institutions	
National Banks	5,784	30.1	Higher Education	3,804
State Banks	8,375	43.5	Vocational	4,231
Mutual Savings	446	2.3	Foreign	792
Savings and Loan	1,663	8.6	Total	8,827
Credit Unions	2,615	13.6		
Direct Loan Programs	8	--		
Other	362	1.9		
Total	19,177	100.0		

Distribution of number of loans by program type, July 1, 1972 through May 30, 1973

Family income	Adjusted Fed.	Adjusted G.A.	Gross Fed.	Gross G.A.	Academic year	Fed.	G.A.
0- 6,000	45%	29%	30%	14%	First	44%	31%
6,001-12,000	30%	41%	33%	25%	Second	13%	20%
12,001-15,000	7%	15%	12%	16%	Third	14%	18%
15,001 & Over	4%	8%	15%	30%	Fourth and Fifth	13%	17%
No response	14%	6%	10%	15%	Graduate	10%	11%
					No response	6%	3%

Race	Fed.	G.A.	Sex	Fed.	G.A.	Age	Fed.	G.A.
White	73%	80%	Male	65%	57%	17-20	21%	37%
Black	14%	10%	Female	31%	40%	21-22	21%	34%
Spanish American	4%	0%	No Response	4%	3%	23-26	28%	20%
Other	2%	1%				27 & Over	25%	9%
No response	7%	9%				No response	5%	0%

[1]Figures as of March 1975. Guarantee Agency data not yet available for month of April.

Note: 1975 figures are through third quarter.

Exhibit 10

STUDENT LOAN INSURANCE FUND

Statement of Financial Condition as of June 30, 1974

Assets	Insured	Reinsured	
Cash and fund balance:			
Cash on hand and in transit		$ 99,235	
Fund balance with U.S. Treasury		14,257,561	
Total cash and fund balance			$ 14,356,796
Accounts receivable			704,705
Loans receivable (note 1)	$ 99,175,047	$ 72,478,464	
Less allowance for losses	54,546,276	39,863,155	
Net loans receivable	$ 44,628,771	$ 32,615,309	77,244,080
Accrued interest on loans receivable	$ 9,013,150	$ 5,931,088	
Less allowance for losses	4,957,231	3,262,099	
Net accrued interest receivable	$ 4,055,919	$ 2,668,989	6,724,908
Other assets:			
Claims in process (note 2)	$ 31,251,954	$ 876,933	
Less allowance for losses (note 2)	17,188,575	482,313	
Net other assets	$ 14,063,379	$ 394,620	14,457,999
Total assets			$113,488,488

Liabilities			
Claims payable (note 2)	$ 32,485,984	$ 901,617	$ 33,387,601
Estimated future losses	273,049,200	104,436,150	377,485,350
Total liabilities			$410,872,951

Investment of the U.S. government		
Capital appropriated	$180,649,000	
Deficit accumulated since inception of program	-478,033,463	
Balance		-297,384,463
Total liabilities and investment		$113,488,488

Note 1. Loans receivable represents the principal balance outstanding on (1) federally insured defaulted loans (the notes are assigned to OE) and (2) reinsured defaulted loans (the notes are retained by the state and private guaranty agencies). OE is specifically prohibited by statute from any collection action on reinsured loans.

Note 2. The liability, claims payable, represents the unpaid claims for defaulted loans on hand as of June 30, 1974. The asset, claims in process, represents the portion of claims payable that will become loans receivable when paid, excluding claims payable because of death, disability or bankruptcy. Losses on unpaid loans receivable represent the amount expensed to the allowance for losses on claims payable.

Note 3. The financial statements as of June 30, 1974, which OE submitted to the Treasury, included a schedule showing the fund's estimated net contingent liability of $2.28 billion for federally insured loans and $2.09 billion for reinsured loans. OE computed these amounts by deducting claims paid and an estimated amount for repayments made by student borrowers from the total amount of loans insured or reinsured. An additional $431 million for federally insured loans and $74 million for reinsured loans was shown on the schedule as the potential contingent liability for loans that had been approved but not disbursed as of June 30, 1974.

Note 4. OE included as expenses amounts that should have been applied as adjustments to prior years' Statements of Income and Expense. This resulted in the Statements of Income and Expense showing an overstatement of approximately $27 million in the estimated future losses on insured loans and an understatement of approximately $46 million in the estimated future losses on reinsured loans. This error did not affect the Statement of Financial Condition.

Exhibit 10

STUDENT LOAN INSURANCE FUND

Statement of Financial Condition as of June 30, 1974 (Continued)

Note 5. The difference between the increase in default claims payable under funds provided on the Statement of Changes in Financial Position and the increase in unpaid loans receivable under funds applied is attributed to the increase in unpaid death and disability claims and bankruptcy claims. With those exceptions, all claims payable will result in loans receivable.

Note 6.

STUDENT LOAN INSURANCE FUND

Statement of Changes in Investment of the U.S. Government for the Fiscal Year Ended June 30, 1974

Balance at beginning of period	-$258,274,249
Funds appropriated	88,668,000
Net income or deficit (-) for year ended June 30, 1974 (see Exhibit 3)	- 127,778,214
Balance at the end of period (Note 3 of Exhibit 1)	-$297,384,463

Exhibit 11

STUDENT LOAN INSURANCE FUND

Statement of Income and Expense for the Fiscal Year Ended June 30, 1974

	Insured	Reinsured	Total
Income:			
Insurance premiums	$ 2,709,807	$	$ 2,709,807
Interest on loans receivable	5,755,341	2,919,291	8,674,632
Total	$ 8,465,148	$ 2,919,291	$ 11,384,439
Expenses:			
Interest on Treasury loan	$ 167,503	$ 92,272	$ 259,775
Losses:			
Death and disability	130,842	267,770	398,612
Accrued interest receivable	3,147,267	1,605,610	4,752,877
Loans receivable	20,471,134	17,769,838	38,240,972
Unpaid loans receivable (note 2)	17,188,575	482,313	17,670,888
Bankruptcy	2,068,487	912,692	2,981,179
Estimated future losses (note 4)	100,572,200	-25,713,850	74,858,350
Total expenses	$143,746,008	-$ 4,583,355	$139,162,653
Total income or deficit (-)	-$135,280,860	$ 7,502,646	-$127,778,214

For notes, see corresponding notes under Statement of Financial Condition (Exhibit 10).

improve its collection experience and administrative cost control.

2 Administrative issues: The program has always felt an acute shortage of human resources. The staffing of the OGSL has lagged the requirements of the job. This has led to a fire-fighting approach to administration. Besides the staffing issue, numerous unpredictable legislative changes have affected the stabilization of any set of administrative procedures.

3 Reporting issues: The OGSL is cognizant of the lack of adequate accuracy and accountability in their reporting.

While the OGSL must live with legislative changes that the Congress deems fit to make regardless of the frequency of such changes, it has realized that its performance could be improved through better organization of its personnel and data. The GSLS II successor system was aimed at improving the organization of program data. The objectives of the system were stated as:

- To protect against abuses
- To reduce administrative costs
- To provide detailed accountability
- To maintain a reliable data base
- To operate within resource limits

The system hoped to address some of the GAO criticisms made in the report of February 12, 1975:

> The Automated Guaranteed Student Loan System, which OE relies on to maintain records of the program, is not functioning properly. The system cannot provide the information needed to prepare accurate financial statements.
>
> OE does not have an adequate program for collecting from defaulted borrowers. As a result, OE cannot identify uncollectible loans or establish a reasonable basis for estimating either current or future losses.
>
> The rate OE used to calculate losses on defaulted loans does not take into consideration experience of the program.
>
> OE has not reported consolidated information on the full cost of the Guaranteed Student Loan Program to the Congress. This program is funded from higher education appropriations, salaries and expenses appropriations, and the Student Loan Insurance Fund.

The accounting system used for the fund has not been submitted to the comptroller for approval.

It was generally accepted that unless the program data were properly organized, control and budgeting would be deficient. Since the OGSL had gone into computerized systems very early in its operations, it was a little surprising that it had unresolved system problems, even after eight years of computerized operations. The following is a brief description of the development of GSLP systems:

THE GSLP COMPUTERIZED SYSTEMS

Pre-systems Era

Though the HEA and NVSLIA were established in 1965, at that time there was no full-time organization within the Office of Education to assume responsiblity for the interest subsidies payable to eligible students.

Interim Systems Era

A task force was set up in 1966 to cope with growing loans under the GSLP. The key personnel consisted of people transferred from the Federal Housing Agency, who had experience in loan insurance; a former college president; and one former student financial aid officer. The immediate concern of the task force was to pay interest subsidies to lenders. The program staff had to design procedures for establishing eligibility of schools for being included in the GSLP and eligibility of students to receive interest subsidies. The GSLP staff could not catch up with the backlog of loans, since procedures had to be designed from scratch. As a result the lenders were asked to submit interest subsidy claims. The GSLP paid lenders on the basis of their claims. The DHEW auditors audited the lender claims periodically, but the audit staff was inadequate to perform a satisfactory job.

In the meanwhile an interim computer system was set up with the help of an outside contractor, based in NYC. The contractor, systems analysts in the Office of Education, and GSLP branch staff discussed the initial system in group meetings. At that stage since most of the personnel working on GSLP were new to the program, rigorous systems specifications could not be drawn up. The computerized system

evolved through joint consultation. The system used optical scanning of documents, which was a new technique at that time. The in-house computer of the DHEW, the RCA 3301, was used for running the system. The system left much to be desired since all coding work, notably school coding work, had not been completed. Without school coding, the GSLP staff could not prepare a list of students, schoolwise, to verify student enrollment. Without such a verification interest payments could not be made automatically. The interest payment system was, therefore, manually run, with periodic audits by HEW staff. The choice of optical scanning also posed numerous data preparation problems. The overload in data preparation led to calling in the services of Providence College for data preparation help. The various problems of the interim system often lead to manual overrides of system controls, in order to tackle emergencies.

GSLS I

To overcome some of the difficulties of the interim system, the program awarded a contract in November 1967 to develop and implement the GSLS I system. The system was not only expected to streamline the loan history file and interest payment subsystems, but also cover the federal program system requirements. (The Federal Loan Insurance was introduced during that period). The system had to have a subsystem for administering premium collection. During the period November 1967 to July 1968, the system in use was largely the interim system. The interest payments continued to be based on lender claims. The volume of loans had reached such proportions that lender audit could not be done even once a year. The problem was accentuated by a large number of small lenders in the system, loaning out to not more than 10 students.

Finally when the GSLS I system was introduced, it is believed that a number of data tapes were lost in the transition. The GSLS I system used the DHEW RCA 3301 computer. The computer tape drives of the RCA system had frequent problems in reading magnetic tape files. The Loan Control Masterfile had grown by then to over 10 reels and every time a read problem occurred, recreating a master file was a big problem. As one systems analyst pointed out, "The files had to be reconstructed many times from the "great-grandfather', 3 cycles back." Additionally

at that time the GSLP staff exercised hardly any influence on the computer systems. The system budget for the GSLP was prepared by the systems analysts in the Office of Education. The priority and time allowed for GSLP work in the central DHEW computer was largely outside the GSLP staff's discretion.

The two problems together made the GSLP look outside for computer time, and permission for this was finally granted. Despite several setbacks, the GSLS I established a fairly complete data base barring the loss of data in transition. However, to cater to the increasing volume and complexity of the system, the GSLP staff decided to go in for GSLS II.

GSLS II

The GSLS II contract was awarded in late 1969, by which time several legislative changes had also come in. The NVSLIA was repealed, the federal re-insurance program was introduced and the special allowance to lenders was initiated. The new system was to cover all these new features and provide management reports for control purposes. In addition, by 1969, the program had run 4 years, and had, therefore, started to encounter default claims and default collection problems in a significant volume.

The GSLS II contract was awarded to a major accounting firm. The implementation of the system stretched through the fall of 1973 and was plagued with a number of problems.

The Office of Education was charged with the following failings:

- The GSLP staff was said to be unclear in their demands of the system. The contract had to be changed for at least 7 major amendments during its implementation.
- The financial accounting requirements were not clearly specified by the comptroller's office in the Office of Education.
- The systems staff in the OE had assigned only two persons to monitor and coordinate the program.
- Major decisions took 4-6 weeks to be made, delaying the project.
- Manual processing resorted to at that time had a large backlog (estimated at 2 to 4 months at the beginning of fiscal year 1971).
- Definitions of default dates and processing dates were constantly changing.

- The regional offices and central office were understaffed to cope with the increasing collection work. That documentation fell behind.

- By a combination of backlog in documentation, inadequate supervision, unclear specification and delayed decision making, the OE contributed to the GSLS II problems.

The contractor for his part had underestimated the job. He was based in Philadelphia. His employees found that the increasing complexity of the job demanded more of their time away from home. Many employees quit, resulting in slippage in the pace of the project completion.

The slippage in implementation created further backlogs and the constant changes in the system led to incomplete documentation of the system. Even before these problems could be fully sorted out, the long delay in implementation attracted the attention of the top officers in the OE. The development of the GSLS II was frozen and the contractor was allowed to get out of contractual responsibility before removing all the bugs in the system.

The management reporting system was particularly hurt by this. A combination of factors such as confused control requirements, delayed processing, slow approval etc., led to a delay of over 6 months in approving the first set of management reports. In the meanwhile, personnel changes in the GSLP administration brought with it changes in ideas on management reports. It is also believed that the internal systems production staff lost the updated tapes during the protracted review.

The OE was not only left with an unproven system in parts, but a poorly documented system from a maintenance viewpoint. The maintenance of the GSLS II was awarded to a contractor in July 1973. The handover time to the new maintenance contractor was merely a month and a number of system maintenance problems remained unsolved.

Since by 1969-1971 many loans began to mature, the budgeting of loan collection and defaults became important. In order to facilitate proper budgeting, the Division of Insured Loans[1] (DIL) was also working on a model to estimate future defaults and future collections. But any projections using models would only be as good as the data base in use.

[1]The GSLP administration was given divisional status at that time.

The GSLS II had a number of problems. In a letter addressed to the DHEW, the GAO pointed out as of Aug. 6, 1973, the problems it saw in the GSLS II system:

GAO ANALYSIS OF GSLS II PROBLEM AREAS:
Analysis of Identified GSLS II Problem Areas

The following outline highlighting problems of GSLS II by functional area was prepared as a basis for discussion. Within each functional area we have summarized the major problems, their related causes, and possible solutions. Related causes and solutions have been assigned corresponding numbers.

INSURED LOANS RECEIVABLE

The GSLS II default master file contains erroneous information on federally insured loans. Internal control over the use of file maintenance is inadequate. Erroneous and/or misleading reports are being produced. The collectability of the loans receivable is unknown. Bankruptcies are still contained in loans receivable.

Apparent Causes

A Processing Procedures Management control over file maintenance is inadequate. The default master file does not contain a record of file maintenance. The editing of file maintenance transactions is inadequate. Some file maintenance transactions make incorrect charges to the default master file. Faulty programming is causing incorrect dates to be inserted in the default master file. The monthly summarization report (trial balance) produced for defaulted insured loans does not include all claims paid or collections received through the report date, and interest computations are not current through the report date. The use of different cutoff dates makes the computation of accurate figures for the June 30 financial statements virtually impossible.

B Collection Procedures Collection efforts are not adequate to determine the collectability of loans receivable.

Possible Solutions

Most errors in the default master file can be corrected by using automated records to reconstruct the entire file. A similar approach is currently being used for the reinsurance program. In addition, the following actions are necessary to improve the accuracy of future processing.

A Processing Procedures Establish stricter controls over the use of file maintenance. Maintain a record of all file maintenance within the default master file. Expand the editing of file maintenance transactions. Correct errors in the programs which process file maintenance transactions. The cost of obtaining correct dates from the original source documents is prohibitive. Consequently, the dates already in the file must be used for processing data currently in the system. However, revision of the computer programs is necessary so that correct dates will be entered into the system in the future. If the use of different cutoff dates is necessary, the heading of each page of the trial balance should show the cutoff date for claims paid, collections received, and interest accrued. Special year end procedures must be developed to provide a uniform cutoff date which includes all transactions and computation of interest through June 30 of each year.

B Collection Procedures Additional efforts must be expanded on the collection of defaulted loans. This is becoming more critical as the statute of limitations approaches on early defaults.

REINSURED LOANS RECEIVABLE

Through the combined efforts of OE and GAO a procedure to construct accurate automated records of reinsured loans is being developed. This procedure currently contains several errors which we hope can be resolved quickly. Since both the computer programs and the processing procedures are essentially the same as those used for insured loans receivable all of the problems and solutions described under that caption apply equally here.

INSURANCE PREMIUMS

The GSLS II pay history file is unreliable for the purposes of determining either outstanding insurance premiums

(accounts receivable) or insurance premium income. Therefore, we have prepared confirmations of accounts receivable maintained by OE on a manual card system.

This card system is incapable of providing information on insurance premium income or historical information on accounts receivable. The card system does not provide an adequate means of reconciling differences between amounts billed and the sum of cash received and accounts receivable. In addition, automated procedures for the billing of overdue insurance premiums cannot be completely implemented until the pay history file is usable.

Apparent Causes

1 An error currently exists in updating the pay history file for insurance premium billings.

2 The pay history file contains approximately $50,000 in unverifiable billings which existed prior to the implementation of the current automated system.

Possible Solutions

1 Review and correct the interface between the pay history file and all other parts of the system. Correct erroneous information currently in the file.

2 Write off all old, uncollectable accounts.

COMMITMENT AND DISBURSEMENT

The current procedures used in maintaining the GSLS II loan control master file will result in lenders with unreported disbursements not being billed for the insurance premiums. Erroneous data is also contained in this file due to faulty updating.

Apparent Causes

1 A match is not required between loan commitment and loan disbursement documents.

2 Overrides of automated controls may cause erroneous data to be introduced into the file.

3 The loan control master file is not being properly updated from the default master file.

Possible Solutions

1 Use a machine readable turnaround document to match commitments and disbursements.

2 Delete overrides which change more than one field.

3 Review and correct the interface between the loan control master file and all other portions of the system.

ESTIMATION MODEL

The development of the model to estimate future defaults and future collections appears to be progressing according to schedule. The model is scheduled to produce preliminary results soon. However, due to errors in the data bases being used it appears that these initial results may not be sufficiently refined to provide acceptable figures for the next financial statements.

An internal assessment of some of the system problems is contained in the memorandum below:

An Internal Assessment of Some of the GSLS II Problems

December 3, 1974

Director, Program Systems Division

Integrity of Reports

1 Many of our reports contain erroneous or misleading information when summary totals are made on lender codes. This is especially true with the "Matured Paper Report". With the emphasis on defaults and defaults rates, this report will be of greater importance with each passing month.

2 The following types of errors are the prime reason for errors in our lender summary totals:
   - a The lenders consolidate processing to a few offices. OGSL fails to make changes to all affected records.
   - b A lender sells loans to another lender. OGSL fails to make lender code changes to all appropriate records.
   - c The lender Master file has errors resulting in the wrong name and/or state being assigned to summary totals.

d Changes were applied to the active loan control Master file (LCMF) but not to the inactive LCMF.

For example, two major problem areas on the Matured Paper Report for the last period:

a The Bank of America consolidated their guaranteed student accounts into two processing centers. Approximately 67 lender codes were consolidated into 2 lender codes. On the Matured Paper Report we list 96 different lender codes. The 94 extraneous lender codes comprise about 48,472 loan records for an estimated dollar value of $41,200,000. The individiual default rates are undoubtedly incorrect. It would be a safe presumption the Matured amount is incorrect.

b The Matured Paper Report shows seven lender codes for the Great Western Savings and Loan Association. The report shows the following salient information:

Loans made	5,829	$6,544,901
Matured		538,345
Default		89,132
Individual matured rate		2 to 21%
Individual default rate		1 to 46%

Further research uncovered that lender code 821837 was assigned to Great Western S&L but this code was shown erroneously with the South Dakota group under the name "Rapid City Reg. Hospital and Nursing School." The salient data for lender code 821837 is:

Loans made	9,535	$10,618,430
Matured		1,373,958
Default		65,222
Matured rate		13%
Default rate		4%

Combining all data we would have a more accurate summary of Great Western S&L Association loan history:

Loans made	15,364	$17,163,331
Matured		1,912,303
Default		154,354
Matured rate		11.1%
Default rate		8.1%

The Matured rate of 11.1% appears low. This could

be a result of loan change transactions not being applied due to lender code errors.

CC: official file
chron file

12/03/74

To overcome the problem of inadequate computer time, the OGSL decided to move its processing out of DHEW in early 1975. The program now had an office status, and a full-fledged division was established within the OGSL to solve the program's system problems.

GSLS II Successor System

As a result of the review made by the Division of Program systems, a Request for Proposal (RFP) for the GSLS II successor system was floated. The objectives of the new system were described earlier. Apart from the overall system improvement objectives, the GSLS II successor system also proposes the creation of an Escrow Account.[2] The OGSL would get direct control on loan disbursements under such an arrangement. Disbursement of loans in the proposed system would be made from the escrow funds only through schools to eligible students, at the authorization of OGSL. The system is expected to guarantee that no loan is disbursed to an ineligible student. The system also proposes use of the services of credit bureaus in locating defaulting students. Exhibits 2-5 describe the proposed system of operations. Since the proposed system is juxtaposed with the present system flow diagrams in the exhibits, the differences in the proposed system are clearly highlighted.

Besides providing timely disbursement and receipt control, the proposed system is also expected to protect students from abuses, by making the schools directly responsible for proper disbursements of loan funds. The anticipated

[2]Escrow Account: Funds held by a third party until the successful fulfillment of an agreement between two other parties. Use of an escrow account guarantees that the funds will be paid if, and only if, the stated conditions are fulfilled.

improvements in the computer systems are expected to improve the OGSL's data analysis and forecasting capabilities.

The new system is estimated to need the resources listed in the table below:

Table I

Costs of System

1. FINANCIAL COSTS	
a) System modification/new design	
GSLS II modification	$1.25 million for 3 years
GSLS II successor system and pilot	$1.90 million for 3 years
b) System operation and maintenance	
GSLS II and pilot operations (currently $3.5 million/year)	$6 to $7 million/year
c) Studies	
Management and organizational	$0.20 million for 3 years
Data audit	$0.675 million for 3 years
2. PERSONNEL	
a) Program Systems Division	
Fiscal year	Additional staff required
1975	7
1976	4
b) Systems level software maintenance	
Increase of 3 to 4 people.	

The system is expected to take three years for introduction:

Design	1 year
Development	1 year
Pilot project	1 year

The system, when implemented, is anticipated to yield the benefits listed in the table on page 292.

Table II

Benefits of New System

	Estimated potential annual savings
DHEW audit performed a survey of major lenders and found an average excess billing of interest subsidy and special allowance of 4 percent, in FY 1976. This 4 percent will be the equivalent of about $18 million per year.	$18 million
Briefings conducted on conceptual level with major lenders have indicated a willingness to pay for their ability to access and use their portions of such a system; assuming 70 percent participation (FISL only) at a rate of 1 percent of outstanding balances (less than they are willing to pay) this would be the equivalent of about $20 million per year.	$20 million
The use of escrow funds with multiple disbursements allows the potential for investment of unused funds on a short term basis (for example, treasury notes).	Not estimated
Pilot studies, based solely on a three-stage letter campaign, conducted after defaults, shows that 25 percent of located students can be induced to make repayment with OE; applying this experience to the pre-claims assistance process and assuming only one-half the demonstrated effectiveness of such a campaign would result in budgetary savings of about $20 million per year.	$20 million
Estimates by OGSL staff show approximately $2 million in uncollected insurance payments due to present inability to match files; this income would be fully recovered through the new system.	$ 2 million

New Pressures on the GSLP

Even as the OGSL was trying to streamline the GSLP, it was hit by a story in the Wall Street Journal of June 30, 1975. The paper claimed that the program was hit by fraudulent practices. It quoted Mr. Charles Cooke, the recently appointed special assistant to HEW Secretary Caspar Weinberger, as stating, "There's no evidence yet of a national network or cabal. But there's certainly malpractice, a lot of misfeasance and a little bit of malfeasance."

In the light of the above publicity, the recent bill proposed by Congressman O'Hara to amend the HE Act of 1965 assumes greater relevance. In various hearings in Washington through 1974 and 1975, there have been testimonies to suggest that states show lower rates of default on student loans, as compared to the federally insured loans. It was implied that the federal scheme administered by the OE was less efficient than the state schemes. The O'Hara Bill seeks to eventually abolish the federal program and offers some reforms in the operation of the program. An extract from Mr. O'Hara's address to the 94th Congress summarizes some of his legislative proposals (see Exhibit 12).

In reacting to the proposed bill, one member of the OGSL commented, "This bill has been proposed just when perhaps for the first time a vigorous attempt is being made to solve our various problems. All the states may not agree to take on the burden of insuring student loans, as the bill requires. But what if they can be persuaded? The federal program would then have to be phased out. The work being done on the GSLS II successor system may become obsolete. Parts of the system would have to be aborted even before they are tried out and parts would need major amendments. We would get back to the vicious loops that kept the past systems from being effective. In a bureaucracy such as ours, I wonder how one plans at all? We must work only on the requirements of the present, for we know not when and what legislations will impact the operations of our program in the future."

Exhibit 12

THE GUARANTEED STUDENT LOAN PROGRAM

Extract from the Speech of Cong. O'Hara (D. Michigan) to the 94th Congress, Feb. 20, 1975

Loans

The next major program in the bill before us is part B--the Guaranteed Student Loan Program. This is a controversial and highly complex program already, and one that is enormously misunderstood.

First, Mr. Speaker, I propose to phase out the direct Federal insurance program--FISL--altogether. The insured loan program has already been plagued by problems, including a mounting default rate, and the testimony before my own subcommittee has convinced me that most of the problems stem from the flaws, perhaps statutory, perhaps administrative, perhaps merely flaws of scale, in the Federal program. It is among schools and lenders primarily insured by the Federal program that we find the major default problem. Perhaps it is merely a question of the greater ability of State agencies to deal each with a small number of lenders and students than of the Federal Government to deal with vast hordes of both. But whatever the reason, I have concluded that the States can do a better job than the Federal Government in this area. I think it is time for us to consider whether we really think we can do everything better in Washington than in the State capitals. My bill will terminate the Federal program after a reasonable interim period during which the States may take up the slack and create State guarantee agencies.

My bill would continue the present 80 percent of loss reinsurance, adding interest and late fees to what we will reinsure. It is my judgment that this minor increase in what we pay out to the State agencies will be scarcely noticeable when contrasted to the enormous amounts we will not be spending on defaulted Federal insured loans.

I am offering one other new provision which I think will help with the default problem. And it reminds me of a sign in a pizza parlor not far from this very Chamber. On the walls of the pizzeria, it says:

> We have an agreement with the bank. We won't cash checks, if they won't sell pizzas.

One of the problems with the present program, Mr. Speaker, is that we are confused about the proper roles of various kinds of institutions and organizations. Colleges

and universities are well equipped to teach things to people. State governments are well organized to govern and regulate. And banks and savings institutions and credit unions are accustomed to being in the lending business. I propose in this bill to encourage each to do what it can best do. I am proposing to limit the definition of "eligible lender" under this program to banks, savings and loan institutions, credit unions, and other commercial lenders. I do not believe we should be in the business of guaranteeing loans made by institutions which are not in the business of lending and collecting money.

This, too, will be a controversial provision, Mr. Speaker, and some of my friends in the academic community will not agree with me. They will say--and they will be right--that this provision may make it harder for some people to get loans--especially, they will say, it will be harder for students who come from poverty and disadvantage to get loans.

Mr. Speaker, that is one of the best arguments I have heard for this change.

I am willing to have a loan component in the student assistance program, but I am deeply opposed to the currently fashionable effort to put most student financial aid on a loan basis. And I believe that asking those students to borrow who have come from the most economically deprived groups and who are going to have, whatever their education, a tougher time than most to find gainful and stable employment when they get out of school, is not offering them "assistance." It is offering them an anaesthetic to take away the pain of increased tuition. It is offering them the least defensible and least helpful kind of "assistance." It is adding to their burdens at a time when we should be trying to lighten those burdens.

I very much hope that those who predict that such an amendment will mean that fewer students will get loans are right. I hope that fewer students will get loans because more students can get grants and work opportunities, and there will be more inducement for the States to use their resources to reduce the inflationary trend in tuitions and fees.

I shall pass, temporarily, over parts C and D of the

new title IV and turn to part E--the national direct student loan program, where the same considerations that moved me to do what I have done in part B have convinced me that this program should be phased out within a year. I propose that the funds now administered by participating institutions should be transferred to those institutions to be used by them for their own student lending programs, if they wish to engage in this business; that there be authorized an annual appropriation of $75,000,000 to reimburse these schools for outstanding loans which have been cancelled or forgiven under the law and that the over $235 million additional we are now appropriating to those programs yearly be turned to other and better ways of assisting students. It is no coincidence, Mr. Speaker, that I propose to reduce the NDSL authorization and increase the amount to go to State incentive grants by just about the same amount. I think it is a better way to spend that money.

In addition to the rewriting of the loan provisions in title IV, the bill as introduced makes two other changes in existing law relating to loans. The "special allowance" which is now payable to lenders over and above the 7 percent interest which a student borrower pays on the guaranteed loan is, under existing law, fixed quarterly by the Secretary of HEW, who works very closely with the Secretary of the Treasury in deciding how much that allowance will be. The Emergency Insured Student Loan Act of 1969 is the basis for this procedure, and gives the Secretary substantial leeway within the 3 percent ceiling.

Section 2 of H.R. 3471 repeals the Emergency Insured Student Loan Act, and adds to the body of part B itself a provision automatically tying the special allowance to the rate payable during each quarter on 90-day Treasury bills. The allowance itself will be the difference between the 7 percent interest ceiling and the 90-day Treasury bill rate for that quarter. What is now a regulatory function, involving substantial uncertainty and frequent long delays, will become an automatic process, and the lenders will know without going further than the morning's paper what the amount of the special allowance will be.

Pacific Cooperative

Henry C. Lucas, Jr.

Introduction

David Martin hung up the telephone in his office at Pacific Cooperative and reached for his calendar. A partner of the Coop's CPA firm had just made an appointment for the end of January. The purpose of the meeting would be to discuss the recommendations of the CPA's Management Services Department for improving information processing procedures at Pacific Coop. Martin wondered what kind of improvements would be recommended. He had been uneasy with computer operations ever since his accounting firm had suggested that problems existed in the computer area.

Background

Pacific Coop is a San Francisco Bay Area cooperative food wholesaler owned by 145 independent stores. The members of the cooperative join to obtain the benefits of economies of scale in purchasing and distribution. The food industry on the retail level is intensively competitive and there is little customer loyalty. Shoppers are influenced by low prices and convenience, primarily in store location. After World War II major food chains began a rapid expansion which included the purchase of many smaller independents.

Pacific Coop was founded in the Bay Area during this turbulent period in grocery retailing by 15 stores. Over the ensuing years, it has grown to include the 145 current members. The Coop had 1975 sales of $275 million. In 1973, Pacific Coop moved all of its operations, including the office and warehouse into a new, one square block building in Oakland, California.

Membership

Members of the Cooperative buy shares and invest an amount of capital in the Coop equal to two weeks' average purchases.

A board of directors is elected by members to supervise the activities of the Coop. The members influence the Coop through the board and through membership on various committees. For example, a new products committee meets semimonthly to decide on new grocery items to be stocked by the warehouse.

The Cooperative strives to make a reasonable profit which is returned to member stores as a patronage refund. The refund calculation is complex because a different percentage is returned for each type of sale, for example, grocery, meat, dairy. Pacific Coop's firm of certified public accountants determines the actual formula to be applied to each year's refund.

New stores applying for membership in the Coop have to meet strict standards, particularly with regard to location. To protect existing members, new members have to be located a certain distance (currently one mile) from existing stores. The Pacific Coop sign is displayed prominently in each store, though the store also displays its name as an independent, for example:

NORRIS BROTHERS

A Pacific Coop Store

The bulk of the stores are independents, but there are three or four chains of 10 to 13 stores each. A large store has a volume of sales in the range of 3000 to 6000 cases a week while a small member might move only 600 cases.

Operations

The cooperative divides its products into the following categories:

Grocery
Meat
Dairy
Fruit and Produce
Drop Shipments

Grocery, fruit and produce, frozen meat and certain dairy items are ordered and distributed through the Pacific Coop warehouse in Oakland. Only diary items with a relatively long shelf life are found in the warehouse, for example, cheeses. Perishable dairy items like milk are delivered

directly to retail stores. "Drop shipments" is the name given to merchandise sent directly to the store, but ordered through the Coop. Fresh meat is handled as a drop shipment; the meat at the warehouse is usually refrigerated in boxes or frozen (e.g. turkeys).

Retail stores order grocery deliveries each week and the warehouse fills the orders. The stores are required to purchase exclusively from Pacific Coop. Fruit and produce, meat and most dairy products are ordered more frequently than once a week because of spoilage. Retailers are billed each week and payment is due by the next week.

DEPARTMENTS

The major departments in Pacific Coop are shown in the organization chart in Exhibit 1.

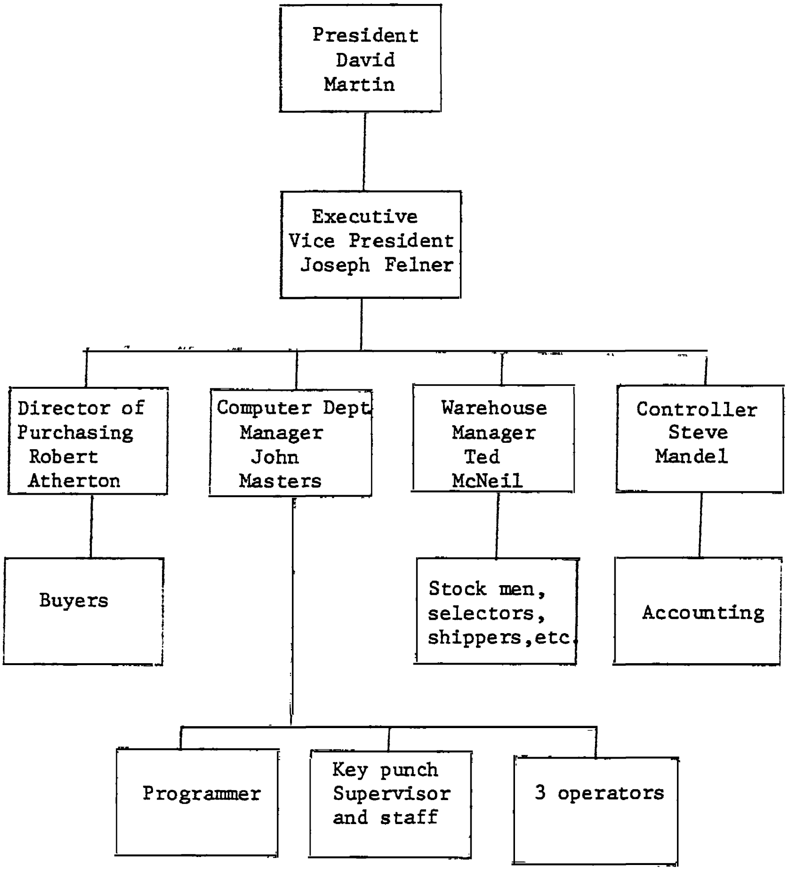
Purchasing

The supply cycle begins in the Purchasing Department which is headed by Bob Atherton. Buyers receive a weekly inventory status run from the Computer Department showing stock status and the last four weeks of movement plus average movement for each item. Inventory status reports are produced more frequently for fruit and produce, and dairy because of their rapid turnover. Buyers use these stock status reports to determine order quantities and reorder points.

As Bob Atherton put it, "We are in business to serve our members; we strive for no stockouts, though we usually run around 1 to 2% stockouts because of bad forecasting on our part or delays in shipments. Our basic rule of thumb is to have two weeks' supply in inventory and one week rolling (that is, in transit)."

A buyer added, "I like to key on seasons. Sales of the product last year at this time are important." The buyers specialize by commodity, for example, there is a candy buyer, dairy buyer, etc. There are six buyers in the grocery area, two in fruit and produce, three in meats, and two in dairy. The buyers try to set up shipments from the different suppliers to take advantage of full car loads and price breaks for volume orders. The chief grocery buyer said: "Sometimes I buy to have more than two weeks' supply in stock because I get a good deal on a box car of merchandise."

Exhibit 1
PACIFIC COOPERATIVE
Organization Chart



Another buyer said, "The real trick is to be familiar with food manufactuers and their representatives. The company's habits are our best basis for forecasting. Some goods like fresh fruit from the San Joaquin Valley arrive in a few days and a rail shipment from the Midwest may take several weeks."

After deciding to place an order, the buyer uses a preprinted form prepared by the computer to write the order. The original copy of the order goes to the food vendor. A copy of the purchase order is kept by the buyer for his own reference and another copy is sent to the receiving area in the warehouse. A final copy is used to verify accounts payable bills from food vendors.

Bob Atherton also stated that, "we have to protect our stores. We plan specials well in advance and order extra merchandise to cover the anticipated higher volume due to the sale."

Naturally one role of the buyer is to obtain the best price. During rapid fluctuations in prices, continued price changes are authorized by Purchasing (Bob Atherton must approve each change). The new prices are used to update the computer inventory file for billing purposes.

Warehouse

The warehouse staff has two functions: one to receive merchandise and place it in its proper location and the other to select orders and ship them to member stores. Most deliveries arrive in the morning and about 95% of the time they arrive on schedule. Pacific Coop averages about 50 trucks unloading a day. The trucks and rail cars are unloaded as quickly as possible and all merchandise is placed on wooden pallets which are stored in pre-assigned "slots" in the warehouse.

A copy of the purchase order, filed in the receiving office, is used to check in shipments. Prior to the arrival of merchandise, the warehouse staff prepares large signs with slot numbers on them to be fastened to the pallets. Fork lift drivers take the loaded pallets to the appropriate slots. These drivers are also responsible for keeping the bottom rack full of goods for the selectors. The warehouse is arranged by product, and fork lift drivers specialize in certain rows. Thus, the drivers become very familiar with the products in their territory.

Selectors use a powered dolly to move pallets through

the warehouse. A selector also usually has a group of rows to which he is assigned. The computer system prints orders in sequence by slot so the selector can move in one direction through the warehouse without retracing his steps.

The selector loads the pallet with the items ordered to form a "cube" of the precise dimensions to fit through the back door of a delivery semi-trailer truck. Missing items are noted on the picking list ("scratches") and a copy of the list is returned to the Computer Department for billing purposes. (Bills cannot be prepared on the basis of picking lists as originally printed by the computer because there is often a discrepancy between book inventory on the computer file and physical inventory in the warehouse.)

There are two selecting shifts and the night shift is the busiest. Day orders are usually split among several selectors to be filled in parallel. At night, one selector might select a whole order and even load the truck. There is a set delivery schedule for each store. Pacific Coop contracts with a trucking agent and does not operate its own fleet of trucks. However, because of the substantial volume of the Coop, the trucks are painted with Pacific Coop signs on them.

The warehouse supervisor offered this example of the service orientation of the Coop, "If we are out of stock, the fork lift driver searches for the item. He gets an inventory report three times a week. I even look for missing items occasionally. (Items are sometimes misplaced or excess goods are placed in an overflow slot away from their designated position.) We get 'short sheets' from the computer which list stores and items they want that the computer says are out of stock. We watch incoming shipments and if the item arrives, we hustle it over to the order pallet being picked for the store. We know the shipping schedule to stores pretty well because we are relatively small. Shorts are a pain in the neck, but the stores love us for keeping stockouts low."

Controller

The controller, Steve Mandel, is responsible for all financial and accounting operations. The Coop requires financing for inventories and for routing operations. There are also many accounting transactions since suppliers

must be paid on a regular basis and stores are billed weekly.

Steve said, "The routine goes pretty well--we aren't too big and everyone cooperates. We get good, reliable service from data processing. Johnny Masters has been here 25 years and he delivers the output. I worry a little bit about control because we seem to have a lot of punched cards and my staff spends too much time checking computer output."

COMPUTER DEPARTMENT

Background

The Computer Department is at the heart of the transaction processing activities necessary to keep Pacific Coop running. The current executive vice president, Joe Felner, set up the first IBM 604 machinery in 1957 and brought Johnny Masters in from accounting to help him.

The major objective of the first system was to keep track of inventories, and this remains the most important computer function today, though now there are other applications including:

Order entry
Inventory status
Grocery catalog
Accounts receivable
Accounts payable
Physical inventory
Payroll
Purchase order printing
Weekly sales report
Patronage refund
Warehouse productivity

Recently Dave Martin, Pacific Coop president, had become concerned over the operation of the Computer Department. A report from the Coop's accounting firm indicated that there were some control problems in the Department, particularly regarding backup and system documentation. The accountants also felt the computer was being underutilized.

Martin asked Joe Felner to prepare a report for him on the current status of operations in the Computer Department so he could review it with a management services representative of the accounting firm. Felner readily agreed since

he had been the "founder" of the Computer Department, though since becoming executive vice president five years ago he had been kept busy by problems with the new warehouse. He observed now, on an equivalent rental basis, the Computer Department budget exceeded $200,000 per year.

Equipment

From the 604, Pacific Coop progressed to an IBM 305, 1401 and a 360 model 30. When the 370 was announced, Pacific Coop purchased a model 135. The current configuration, which represents an investment of over $500,000, consists of:

Model 135 central processing unit
96K bytes of memory
2 line printers
4 model 3330 disk drives
1 card reader/punch
Various EAM equipment (sorters, interpreters, etc.)

There are no tape drives on the system because direct access storage has always been used for the inventory file to fill orders.

Pacific Coop also owns an IBM System 7 which is dedicated to meat, dairy and produce ordering. Store representatives phone the System 7 and use a touch tone pad attached acoustically to the phone to enter orders for these perishable items. After ordering during a scheduled time period each day, the orders are processed in batch mode on the 370. The new phone system uses a package program developed by a grocery wholesaler in Pennsylvania and replaces the old approach of phoning orders to keypunch operators. As one retailer put it: "I suppose the phone orders save the Coop and us some money, but it sure has been tough getting my produce man to push all of the little buttons and listen to the tones."

The 370 is currently running under the disk operation system (DOS) with two to three partitions depending on the job. A special spooling package is used to put reports on a disk and print them later during other processing. Operations are hampered, however, by having to emulate many programs originally written for th 1401. These programs, particularly for processing inventory, have not been converted to COBOL for the 370.

As a result of not converting yet "we waste a lot of space because emulating files on the 3330's takes a lot more room than running in native 370 mode. We have about 8 million characters in the inventory file under 1401 mode and I estimate this would require only about 2-1/2 million in native mode," said Pacific Coop's only full time programmer.

He added, "We've been trying to convert, but there just isn't time. Johnny has to manage the Department and he's the only one who can convert the 100 or so 1401 Autocoder programs to COBOL for the 370. The only documentation on these programs is the actual input, output, and the program listing itself. I'm kept busy with special requests like going to LIFO inventory. I also work on a new system for general ledger when there is time. Of course, I am responsible for the operating system and have to generate a new one when there are major changes from IBM."

The programmer went on to explain that they were almost out of disk space and were wondering about requesting additional drives. However, Pacific Coop likes to keep expenses low and Johnny had been afraid to request additional money. The computer currently runs about 10 hours per day, five days per week.

Applications

The most important application at Pacific Coop is the order cycle, from entry through billing. The computer processing involved in this order cycle is illustrated in Exhibit 2. Preparing orders for the warehouse has priority over all other processing and orders are run several times a day. Orders for the different inventories are run at different times, for example, grocery, dairy, fruit and produce, etc.

An order book is printed for the stores showing the merchandise currently stocked by the warehouse. Four decks of mark sense cards are sent to each member grocer every week. These cards are prepunched with the store number on them and fit on rings on one side of a loose leaf binder with the order book on rings on the other side. One line in the order book corresponds to one line on a mark sense card. Store personnel order by darkening the quantity desired on a mark sense card line aligned with the item line in the order book, so by turning one page and card, the individual ordering keeps the cards coordinated with the order book. While the process does not represent the most modern technology,

it has been used successfully for a number of years. The order decks are dropped off by the grocer in Oakland for processing.

On the average there are about 1300 to 1500 items on a weekly order. When the order decks are received at Pacific Coop, the Computer Department runs the mark sense cards through a 519 interpreter which produces a standard punched card. The punch cards (or the file of orders from the System 7 for meat, dairy and produce) are used to print picking orders for the warehouse. Before any picking order is run, however, the inventory file is updated with receipts of goods so the information on stock status will be up to date.

The picked orders are sorted into slot number sequence by store for the warehouse selectors. The computer also prints a recommended price sticker for the items. Grocers can select which price category they wish to use, for example, low, medium and high. Prices for each product in that category are then printed on the stickers which are affixed to the cases picked. At the same time the order is selected, the inventory file is updated to show that the merchandise has been picked and an accounts receivable card is punched and placed in a manual card file. This entire system is run in emulate mode except for several COBOL print programs.

An inventory status report is also prepared and distributed as a part of the inventory system. This report is watched closely by the buyers and is used in the warehouse as well.

Accounts receivable at Pacific Coop runs about 5 to 6 million dollars while inventory averages 7 million dollars. The average inventory turnover is one to two weeks for grocery items, though fruit and produce turn over in a few days. The accounts receivable manual card file is processed by the computer regularly to produce reports for control and verification. If an item has not been picked in the warehouse because it is out of stock, the picking list copy returned from the warehouse notifies the Computer Department of the out of stock condition. The accounts receivable card is pulled from the card file and destroyed (or if a partial shipment, a new card is punched manually).

Weekly the accounts receivable file is updated on the computer to reflect receipts. Prior balances, receipts and new accounts receivable cards are run to produce in-

voices. The invoices are created separately for each type of order (for example, meat, produce, etc.) and then sorted by store before printing so they can be mailed in a single envelope.

For accounts payable, a card is punched by the keypunch section for each payable. Daily balance runs are made on these payable cards. As the due date for a payment draws near, the cards are pulled and used as input to a computer run which generates checks. There is also a run of scheduled and outstanding checks, though there is no check reconciliation by computer.

The payroll system has been a real problem at Pacific Coop. It was programmed on a contract basis by a software house which failed to provide an adequate product. A number of different staff members at the software vendor worked on the system and it ended being written in some three different computer languages! Errors and user resistance problems at Pacific Coop resulted in an 18 month implementation period.

There are also a number of other small applications including sales reports, warehouse productivity reports by selector, preprinting of purchase orders, etc. At year end, the Computer Department also runs refund checks after the refund is calculated by their CPA firm. Every six months a physical inventory is taken and the book inventory on the computer files is adjusted to correspond with actual inventory balances. There may be up to six physical counts before the inventory figures are accepted. Duplicate copies of critical files are made regularly and stored in a fireproof vault in the building.

A typical day's processing might have the following schedule:

A.M.	
6:00-10:00	Process orders to give warehouse at least 12 by 7 a.m.
10:00-11:00	Run receiving for dairy and grocery
11:00-11:30	Process dairy orders and print the dairy inventory status report
11:30-12:00	Run other receiving and begin meat orders

P.M.	
12:00-12:45	Process more grocery orders
12:45-1:30	Run accounts payable and drop shipments
1:30-2:00	Process dairy orders
2:00-2:30	Run receiving and adjustments
2:30-3:15	Process fruit and produce orders
3:15-5:00	Run more grocery orders
5:00-6:00	Program testing

Several new applications are planned by the Computer Department. One goal is, of course, to convert the 1401 programs to COBOL. The general ledger is another application which has high priority. Pacific Cooperative has also been thinking about trying to provide computer services for some of its member stores. The Coop has a print shop which has been making a good profit by printing all signs and special advertising for members. Johnny noted that "several of our members are big enough to have their own mini-computers or use a service bureau for payroll and accounting work. Given the extra time on the computer available off peak shift, we should be able to do this processing more cheaply."

The IBM representative for the account also pointed out that one reason for acquiring the 370/135 was to be ready for point of sale systems. These systems utilize electronic scanners in the stores or electronic cash registers. The central computer maintains an in-store inventory and prepares reorders for the warehouse automatically. While a complete system alone would probably be too expensive for a member store, Pacific would be in a good position to offer point of sale service to all member stores.

Joe Felner had also thought several times about investigating the IMPACT inventory control package. "Our present inventory system is not too sophisticated; we basically keep track of what we have. I know there are some packages like IMPACT which have mathematical models to help in forecasting and recommending reorder quantities. However, Bob Atherton is really opposed to such systems. He says they remove human judgement which is necessary given the complexity of the buying decision and that people he knows with IMPACT say it doesn't work. I would still like to investigate it to be sure we are not missing an important opportunity."

Conclusion

David Martin discussed the status of the Computer Department with the management service representative of his accounting firm. The consultant, after interviewing the computer staff and users, confirmed the accuracy of the material presented above. He now wondered what to recommend at the planned January meeting to improve the Coop's information processing activities.

Exhibit 2
PACIFIC COOPERATIVE
Basic Processing

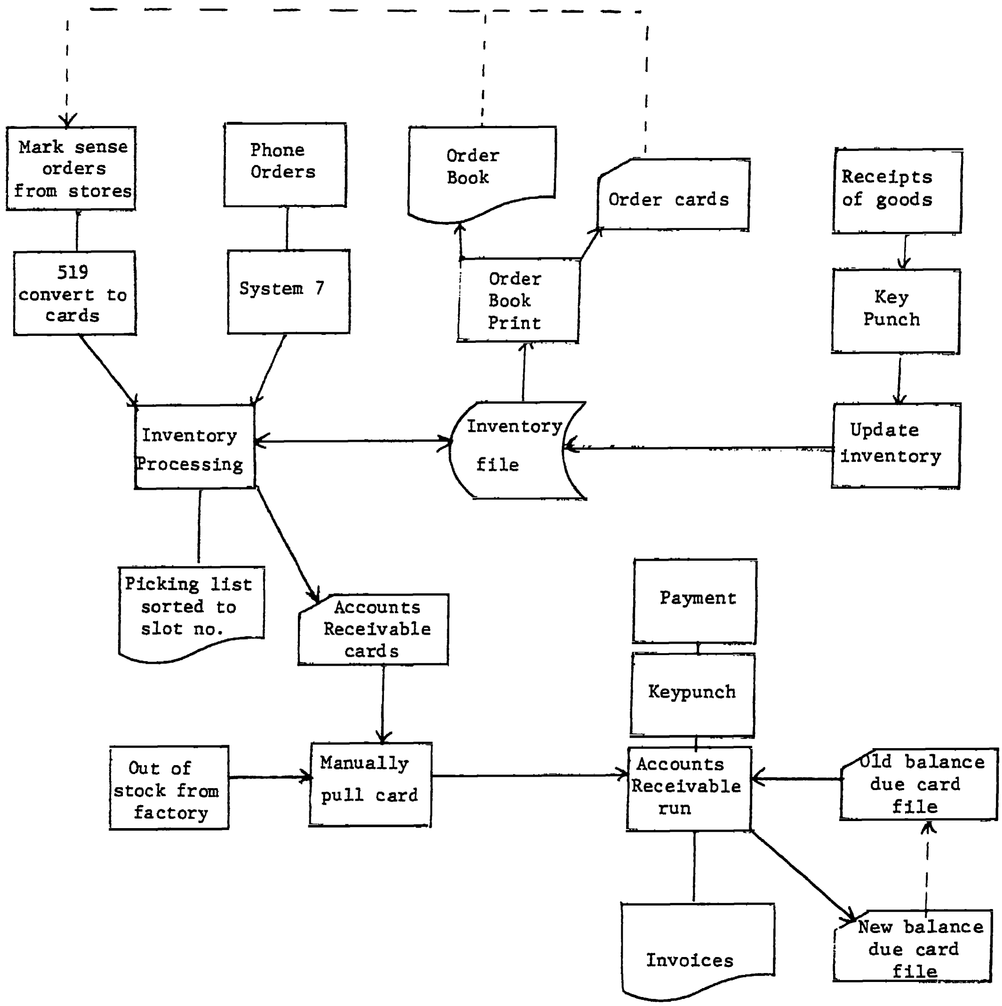
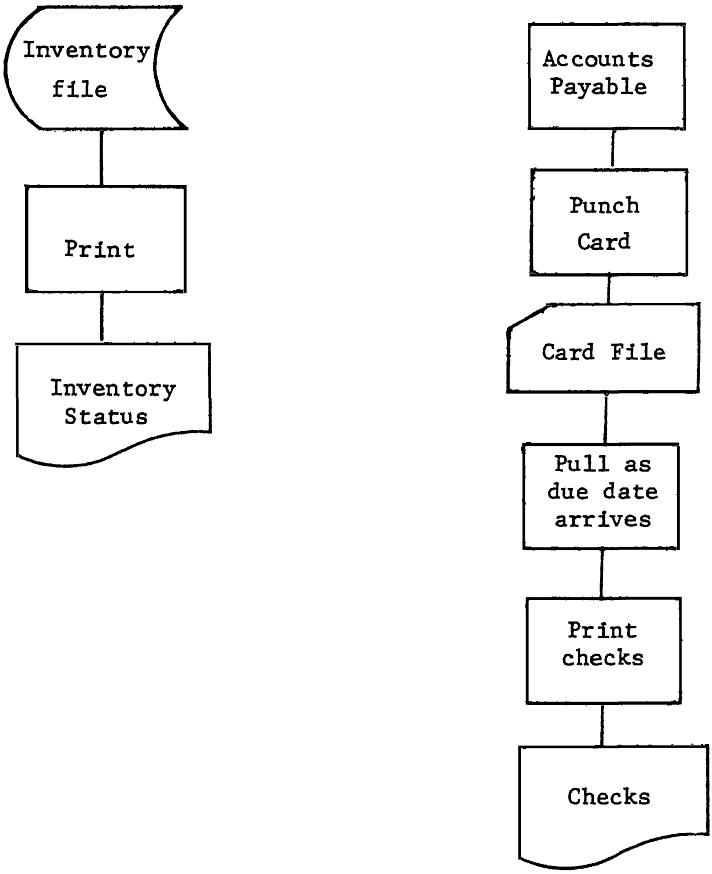


Exhibit 2
PACIFIC COOPERATIVE
Basic Processing (Continued)



Realtronics Data Corporation

Terry Allen

In August, 1974, Thomas Alden, founder and 60% owner of Realtronics Data Corporation (RDC), commented on his data processing experience. "I don't know what computers have against me, but they sure have tried to mess things up. We have a simple computer job--sorting and listing, that's all. In our four years of existence we have tried five entirely different systems. Our programs have been written in three different languages. The best system we had turned out to be unsatisfactory, the worst system was almost disastrous. Now our service bureau has almost doubled their fee for processing our data. What's worse--their service stinks! Half the time, the jobs are not run on time, and the other half the time you can't read the tops of the letters on the printed output--and they want to double the price?"

BACKGROUND

In early 1969, Thomas Alden was a realtor[1] and a member of the Multiple Listing Service (MLS) Board in Providence, Rhode Island. He had taken several data processing courses in pursuit of an MBA degree at a local university. It seemed to him that much of the real estate data handled by MLS could be more efficiently processed by a computer. In addition to lower costs and faster reporting, the computer would make considerably more information available to MLS members than they were getting from their manual system.

He went to a national realtor's convention in July, and came away with some ideas for a computer service for MLS boards across the country. In less than two months'

[1]"Realtor" is a registered name for a real estate agent who is a member of the National Association of Real Estate Boards.

time, he raised $120,000 from three local investors (one of whom owned the printing company that would be his largest supplier). Realtronics Data Corporation was soon born, with the Providence MLS as its first customer. Within three months, he had two other boards under contract --one in New York and the other in California.

THE SERVICE

RDC sent to each MLS board a weekly "book" for each of its members. This book provided the realtor with his total "inventory" of properties to sell. Due to the critical importance of this book to each realtor, RDC had to deliver it within 48 hours of receiving the listings from the MLS office. The book was divided into three sections:

1 Photo-listings of every house available for sale through MLS. (Exhibit 1) The photographs were generally arranged by price within each house size (number of bedrooms) within each geographical unit, although each board could specify its own preference for arranging the photographs.
2 Computer listings of houses currently available. Current listings were arranged by bedroom-number and price within each geographical area (Exhibit 2), by streets within each geographical area (Exhibit 3), and by listing number assigned to each new listing.

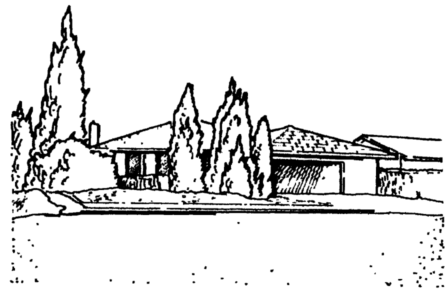
The computer listings were used as a reference to find the location of the photo-listings. For example, if a prospective customer was interested in a three-bedroom house with a fireplace and garage selling in the upper $30,000's, the realtor would consult the computer listings for a summary of every property available with those characterisitcs and find the picture number of each such property.

3 Other computer listings. Included in this section were:
   a Summary of last week's sales statistics. (Exhibit 4)
   b Listings sold, expired (the original listing period had run out) and withdrawn for week. (Exhibit 5)
   c Active listings broken down by individual real estate offices (a single computer listing for each office; this report was not printed in the "book").

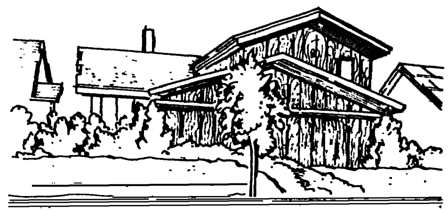
Exhibit 1

REALTRONICS DATA CORPORATION

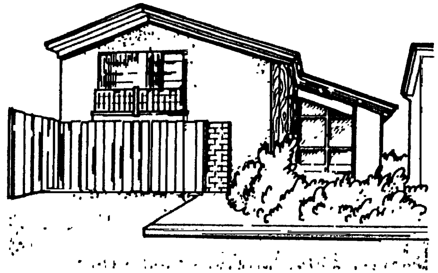
Address 17372 Laurie Lane, Tustin ML 5717-73
Nearest X Streets Yorba District 2
Type of property 4BR, LR, FR, DR Legal (943) TG# 17 F 5
Bdrms 4 Sq Ft 1950 Age 7 Poss COE Price $51,500
Lvg Rm 14 x 17 Floors Sl/Cpt Zone R-1 Cash Dn $5,150
Fam Rm 12 x 19 Entry Hall yes Roof WS 1st TD $30,100 Type C
Sep Yes X No Fireplace LR Fenced BW Payable $285.00 Moly 7½ %
Den - x - Heat FA Sprkrs Front Held By SOUTH BAY
Din g Rm 11 x 12 Serv Porch no Patio yes 2nd Td $752
Sep Yes X No 220 Volt yes Sewer yes Payable $28 Moly 7½ %
Bath 2.50 Tile yes Garage TA Sewer conn. yes Due Date 5176
SS 2 OT 1 Pool no Bonds - OWC/Cons 2nd TD $ -
R/O Gas 2 Dwshr yes Sr High Foothill Trlr Access CB Payable $- Moly - %
Disp. yes Cab Nats Elmtry Loma Vista Jr High C.Tustin Taxes $870.00 Incl -
Eating Area DR,FR,Bar Lot Size 80x100 Vacant No Vet Xmpts HO Impds -
How shown By Appt. L/Box - W/Trade Nothing
Owner's name H & J Mannion-same-838-9403 (1b)
Listing Office FOREST E. OLSON-Marjorie Moore, Ted Pisarzuk-633-5180
LP incl.w/w cpts,window coverings,Gourmet Kit w/dlbe oven & Gas BBQ + instant hot water + food center.Slr to clean cpt.Triple garage
INFORMATION DEEMED RELIABLE BUT NOT GUARANTEED TO BE CORRECT —



Address 1702 Summerville, Tustin ML 6146-73
Nearest X Streets Redhill, Sycamore, Glenarbor District 2
Type of property 4BR, FR, DR Legal (9273) Lot 22 Tr 6447
Bdrms 4 Sq Ft 2214 Age 4 Poss COE Price $ 52,750
Lvg Rm 14 x 18 Floors cpt/tile Zone R-1 Cash Dn $ CTNL CTL
Fam Rm 12 x 20 Entry Hall yes Roof shake 1st TD $ 27,200 Type VA
Sep Yes x No Fireplace yes Fenced yes Payable $ 294. Moly 7½ %
Den - x - Heat fa Sprkrs yes F Held By Security Pac
Din g Rm 10 x 14 Serv Porch no Patio yes 2nd Td $ -
Sep Yes x No 220 Volt yes Sewer yes Payable $ - Moly - %
Bath 2½ Tile yes Garage da Sewer conn yes Due Date -
SS 1 OT 1 Pool comm Bonds no OWC/Cons 2nd TD $ small
R/O BI elec Dwshr yes Sr High Tustin Trlr Access no Payable $ - Moly - %
Disp yes Cab wal Elmtry Thorman Jr High Currie Taxes $ 948apx Incl yes
Eating Area yes Lot Size 50x100 Vacant owner Vet Xmpts HO Impds yes
How shown Call 1st 838-7907 L/Box yes W/Trade cash
Owner's name J & J LaRosh - same - 838-7907 (1a)
Listing Office DONALD M. BIRD & ASSOC. - Jacqueline Graves - 832-8800
LP incl cust made drps,w/w cpts,bkshlvs.Prof lndscpd very attractive burnt org decor.4th BR xtra lge dormer type.Immac CDS.Wlkg dist to P.park
INFORMATION DEEMED RELIABLE BUT NOT GUARANTEED TO BE CORRECT —



Address 5513 Edgemar, Anaheim ML 6341-73
Nearest X Streets Santa Ana Cyn Rd, Imperial District 1
Type of property 4BR, LR, FR, DR Legal (1083)
Bdrms 4 Sq Ft 2300 Age 1 yr Poss COE+3days Price $ 52,900.00
Lvg Rm yes X Floors Slb/HW Zone R-1 Cash Dn $ ASSUMP ONLY
Fam Rm yes X Entry Hall / Roof Cedar-Shngl 1st TD $ 36,336 Type VA
Sep Yes yes No Fireplace Brick Fenced BW, GS Payable $ 265.00 Moly 7 %
Den - X - Heat FA Sprklrs Front Held By GREAT WESTERN
Din g Rm yes X Serv Porch Garage Patio Slab 15x18 2nd Td $ -
Sep Yes yes No 220 Volt - Sewer TCP Payable $ - Moly - %
Bath 1 3/4, ½ Tile - Garage DA Sewer conn. yes Due Date -
SS - OT - Pool no Bonds none OWC/Cons 2nd TD $ -
R/O Elec Dwshr. yes Sr High VP Trlr Access - Payable $ - Moly - %
Disp. yes Cab. - Elmtry V.D.Rio Jr High Crescent Taxes $ unassessed -
Eating Area - Lot Size 50x105 Vacant no Vet Xmpts - Impds -
How shown Lock Box L/Box yes W/Trade no
Owner's name W & M Callen-same-637-5866 (1b)
Listing Office GOLD COAST REALTY-Phyllis Janzen-772-1222
Central air, cpts, & drps, all hanging lamps, wet bar, TVant, Btfl new hm. The $2,750 owed on air/cond will be pd off. Escrow to be 30 days in length.



Address 14841 Devonshire, Tustin ML 5334-73
Nearest X Streets Red Hill, Sycamore District 2
Type of property 4BR, FR, DR Legal (8163) Lot 101 Tr 6447
Bdrms 4 Sq Ft 2154 Age 4 Poss COE+3days Price $ 52,950
Lvg Rm 14 X 18 Floors slb/cpt Zone R-1 Cash Dn $ CTL or CTNL
Fam Rm 12 X 20 Entry Hall lge Roof c/s 1st TD $ 28,800 Type FHA
Sep Yes x No Fireplace yes Fenced B.B Payable $ 210 Moly 7½ %
Den no X Heat fa/ac Sprklrs F & R Held By Sec Pacific
Din g Rm 10 X 14 Serv Porch gar Patio lg cov 2nd Td $ none
Sep Yes X No 220 Volt yes Sewer yes Payable $ - Moly - %
Bath 2½ Tile - Garage da Sewer conn yes Due Date -
SS 1 OT 1 Pool comm Bonds none OWC/Cons 2nd TD $ no
R/O elec Dwshr. yes Sr High Tustin Trlr Access no Payable $ - Moly - %
Disp. yes Cab. P Elmtry Thorman Jr High Curris Taxes $ 823 Ind -
Eating Area lge Lot Size irreg Vacant owner Vet Xmpts HO Impds 91
How shown Call 1st 838-8662-no ans come L/Box FD W/Trade -
Owner's name R & E Miller - same - 838-8662 (ja)
Listing Office F. M. TARBELL - Wil Gower - 832-7051
4 ton auto cool w/air return electrostatic filter, Dble hung drps, crystal chandelier DR, conversation pit, Tustin Meadows plan 16B, Swag lmps, wtr sftnr, TV antenna not incl, 2dogs in back. Outside trim

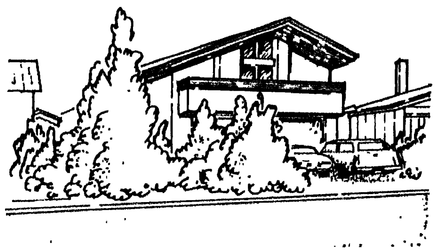


Exhibit 2

REALTRONICS DATA CORPORATION

Area, Bedroom and Price Index

- A R E A 01 BRISTOL -

.....2 BEDROOMS OR LESS.....

	ADDRESS	PRICE	OVR 2 BATHS	GAR	DSP KIT	RC/FM ROOM	LOT_SIZE	PIC#
	34 SOWAMS DR	22,500					75 X 110	1
	1119 HOPE ST	34,900		X	X	X	50 X 120	2
	6 PRENDA LN	35,400			X	X	100 X 150	3
	43 WHIPEWORTH AVE-42	48,000			X		200 X 120	4

.....3 BEDROOMS.....

	ADDRESS	PRICE	OVR 2 BATHS	GAR	DSP KIT	RC/FM ROOM	LOT_SIZE	PIC#
	37 ROBIN DR	23,900		X	X		90 X 115	5
	25 WISEDALE DR	25,500			X		69 X 120	6
	16 GREENWAY DR	26,900		X	X	X	70 X 115	7
	1 BRAY LN	34,500		X		X	IRREG	8
	74 BERRY LN	34,900	X				107 X 145	9
...NEW.	24 ROOSEVELT DR	35,000		X			100 X 164	10
	6 ROOSEVELT DR	37,000		X			150 X 100	11
.REDUCE	48 ROOSEVELT DR	37,500		X	X	X	101 X 145	12
	40 ROOSEVELT DR	37,900		X	X		100 X 154	13
	1 SANDRA DR	38,500		X	X			14
	16 FOX HILL AVE	38,900	X	X		X	40 X 138	15
.REDUCE	44 MONROE AVE	39,900					56 X 106	16
	33 ROOSEVELT DR	43,900		X	X	X	101 X 150	17
...NEW.	16 HAMPTON VIEW AVE	43,900		X		X	100 X 200	18
	2 COLONIAL RD	48,900		X	X	X	60 X 100	19
	5 ERICSSON LN	49,900		X		X		20
	7 ROOSEVELT DR	52,500	X		X	X	117 X 135	21
	6 AMBROSE DR	58,500		X	X	X	100 X 200	22

.....4 BEDROOMS.....

	ADDRESS	PRICE	OVR 2 BATHS	GAR	DSP KIT	RC/FM ROOM	LOT_SIZE	PIC#
...NEW.	156 FATIMA DR	37,500					50 X 100	23
	27 HEALM RD	39,900		X	X	X	150 X 115	24
	63 BERRY LN	39,900	X		X		150 X 100	25
	16 DONNA ST	49,900		X		X	80 X 115	26
	60 CHURCH ST	59,900		X	X	X	67 X 84	27
	12 ERICSSON LN	60,000	X	X	X	X	95 X 120	28
	9 SANDRA DR	69,500	X	X	X	X	IRREG	29
	55 SHORE RD	125,000	X	X		X	149 X 168	30

.....5 BEDROOMS OR MORE.....

	ADDRESS	PRICE	OVR 2 BATHS	GAR	DSP KIT	RC/FM ROOM	LOT_SIZE	PIC#
	24 COURT ST	28,500					53 X 80	31
	35 CENTRAL AVE	40,000			X			33
.REDUCE	124 BRADFORD ST-131	47,500		X			66 X 119	32

***** 3 FAMILY DWELLINGS *****

ADDRESS	PRICE	OVR 2 BATHS	GAR	DSP KIT	RC/FM ROOM	LOT_SIZE	PIC#
43 NOYANK ST	42,400		X	X		40 X 77	34

***** COMMERCIAL *****

ADDRESS	PRICE	OVR 2 BATHS	GAR	DSP KIT	RC/FM ROOM	LOT_SIZE	PIC#
213 STATE ST-125	77,000						35

- A R E A 03 WARREN -

.....2 BEDROOMS OR LESS.....

ADDRESS	PRICE	OVR 2 BATHS	GAR	DSP KIT	RC/FM ROOM	LOT_SIZE	PIC#
463 MONROE AVE	19,800					40 X 80	36

.....3 BEDROOMS.....

	ADDRESS	PRICE	OVR 2 BATHS	GAR	DSP KIT	RC/FM ROOM	LOT_SIZE	PIC#
	464 LINCOLN AVE-A	25,900			X		80 X 80	37
	365-A PARKER AVE	31,900			X	X	90 X 120	38
	363 PARKER AVE	31,900			X		80 X 120	40
	23 BRJAU ST	31,900	X	X		X	50 X 77	39
	276 PENNSYLVANIA AVE	32,500			X	X	150 X 100	41
	1 LEE DR	35,000		X	X	X	80 X 94	42
...NEW.	2 MANLEY LN	36,900		X			100 X 100	43
	4 PINE LN	37,500		X	X	X	110 X 130	44

.....4 BEDROOMS.....

ADDRESS	PRICE	OVR 2 BATHS	GAR	DSP KIT	RC/FM ROOM	LOT_SIZE	PIC#
428 LAUREL LN	42,500		X	X	X	108 X 73	45

.....5 BEDROOMS OR MORE.....

	ADDRESS	PRICE	OVR 2 BATHS	GAR	DSP KIT	RC/FM ROOM	LOT_SIZE	PIC#
...NEW.	15 HARRIS AVE	54,000	X	X	X	X	100 X 142	46
	572 MAIN ST & 13 GREE	58,900	X					47

***** LAND *****

ADDRESS	PRICE	OVR 2 BATHS	GAR	DSP KIT	RC/FM ROOM	LOT_SIZE	PIC#
TOUISSET RD	75,000						48

- A R E A 05 BARRINGTON -

	ADDRESS	PRICE	OVR 2 BATHS	GAR	DSP KIT	RC/FM ROOM	LOT_SIZE	PIC#
	20 HILLSIDE	29,500				X	116 X 120	51
	1 WRIGHT ST	31,500		X	X			52
	7 ELLIS ST	34,500		X	X		13027 SQ F	53
...NEW.	86 FERRY LN	42,500		X	X		99 X 336	54
	17 ADAMS PT RD	43,500		X	X	X	100 X 155	55
	79 WATER WAY	72,000	X		X		160 X 160	56

.....3 BEDROOMS.....

	ADDRESS	PRICE	OVR 2 BATHS	GAR	DSP KIT	RC/FM ROOM	LOT_SIZE	PIC#
	1 CONGRESS RD	27,500		X	X			57
.REDUCE	9 MIDDLE ST	29,900		X	X		100 X 125	58
.REDUCE	90 HAMILTON AVE	30,000		X	X		IRREG	59
	11 JAY ST	31,500		X	X		70 X 90	60
.REDUCE	74 WALNUT RD	36,500	X			X	50 X 200	61
	210 SOWAMS RD	36,900		X		X		62
	80 LINCOLN AVE	37,250		X	X			63
	4 STANLEY AVE	39,000		X	X			64
	51 LAMSON RD	39,900				X	105 X 110	65
	56 MARTIN AVE	40,500		X	X		89 X 350	66
	10 MILTON RD	41,000		X	X	X		67
	24 HIGHVIEW AVE	42,500		X	X	X	100 X 110	68
	12 BULLOCK AVE	43,900		X	X			69
	66 GOVERNOR BRADFORD	44,900		X	X	X	125 X 88	70
	8 CARLTON ST	45,500	X	X		X	100 X 130	71
	28 CHRISTINE DR E	46,000		X	X	X		72
	130 WASHINGTON RD	47,000		X		X	150 X 100	73
...NEW.	25 FAIRWAY DR	48,000		X	X	X	100 X 100	74
...NEW.	146 MIDDLE HWY	48,000		X	X	X	125 X 125	75
	8 FIRESIDE DR	48,500		X	X	X	IRR	76
	10 JENNYS LN	48,500		X	X	X		77
	24 MANNING DR	48,900		X	X	X	100 X 120	78
	11 ELEANOR DR	49,500		X	X	X		79
	651 COUNTY RD	49,900	X	X	X	X	100 X 152	82
...NEW.	45 FOUNTAIN AVE	49,900		X	X	X	100 X 100	81
	40 MIDDLE HWY	49,900	X	X		X	134 X 106	80
	8 DANA RD	49,900		X	X	X	100 X 100	83
	29 LAKE DR N	50,000			X	X		84
	223 LINCOLN AVE	50,000		X	X			85
	31 FERRY LN	53,000		X		X		86
	6 NEWBROOK DR	54,500		X	X	X		87
	6 TIFFANY CIR	56,500	X	X	X	X	100 X 105	88
	13 GLENFIELD RD	58,500		X	X	X	149 X 193	89
	11 ELMO DR	69,500		X	X		IRREG	90
	254 NAYATT RD	69,900	X	X	X	X	IRREG	91
	35 LAKE DR N	70,000		X		X		92
...NEW.	4 HALF MILE RD	76,500	X	X		X	220 X 161	93
	71 CENTRAL AVE	80,000		X				94
	11 METHERSON RD	125,000	X		X	X	IRR	95

.....4 BEDROOMS.....

	ADDRESS	PRICE	OVR 2 BATHS	GAR	DSP KIT	RC/FM ROOM	LOT_SIZE	PIC#
	72 HIGHLAND AVE	34,900	X	X	X		100 X 94	96
	10 MASSASOIT AVE	35,900		X	X	X		97
...NEW.	4 PAUJIN RD	39,800	X	X			70 X 170	98
	21 FOMITE ST	39,900	X		X		100 X 112	99
...NEW.	21 CHRISTINE DR-E	42,500	X	X	X		135 X 102	100
...NEW.	31 BLUFF RD	44,000		X	X	X	80 X 100	101
	37 WALNUT RD	47,900		X	X	X		102
	25 CHARLES ST	49,500	X	X			140 X 80	103
	37 LINCOLN AVE	49,500		X	X	X		104
	25 KING PHILLIP RD	49,900			X		63 X 100	105
	5 JENNINGS STONE RD	52,500		X	X	X	101 X 110	106
	22 BROOKFIELD AVE	53,500		X	X	X		108
	10 CHRISTINE DR	53,500		X		X	104 X 200	107
	17 HILLSIDE AVE	54,000	X	X		X	120 X 80	109
	349 NAYATT RD	58,500	X	X		X	100 X 113	110
	1 BLOUNT CIR	59,000		X	X		IRREG	111
	4 PLYMOUTH DR	59,500		X	X	X		112
	105 GOVERNOR BRADFORD	59,500	X	X	X	X	IRR	113
	11 FERRY LN	59,500		X	X	X	135 X 104	114
	5 WESTWOOD LN	62,500	X	X	X	X		115
	6 FERNCLIFFE RD	64,500		X	X	X		116
	11 CANDLEBERRY RD	64,900		X	X	X	IRR	117
	8 DEVONSHIRE DR	68,000	X	X	X	X		118
	426 SOWAMS RD	68,000	X	X	X	X	113 X 100	119
	14 FIRESIDE DR	69,900	X	X		X	IRR	120
	291 NAYATT RD	69,900	X	X	X	X		121
	19 BRIARWOOD DR	72,500	X	X	X	X		122
	12 CANDLEBERRY RD	73,500	X	X	X	X	100 X 155	123
	3 IDA COURT	75,000	X	X	X	X	IRREG	124
	11 JENNYS LN	79,000	X	X	X	X		125
...NEW.	7 VIALLS DR	79,500	X	X	X	X	IRREG	126
...NEW.	16 ROBBINS DR	79,500	X	X	X	X	150 X 167	127
	283 NAYATT RD	79,500	X	X		X		129
	8 VIALLS DR	79,500	X	X	X	X		128
	15 LEE RD	79,900	X	X	X	X		130
	4 KAREN DR	85,000	X	X	X	X		131
	2 TALLWOOD DR	86,000	X	X		X		132
	29 OLD CHIMNEY RD	89,500	X	X	X	X	IRREG	133
	37 NEW MEADOW RD	102,500	X	X	X	X		134
	36 WOODLAND RD	110,000	X	X	X	X	IRREG	135
	105 RUMSTICK RD	125,000	X	X		X		137
...NEW.	29 FAIRWAY DR	125,000	X	X		X	IRR	136

.....5 BEDROOMS OR MORE.....

	ADDRESS	PRICE	OVR 2 BATHS	GAR	DSP KIT	RC/FM ROOM	LOT_SIZE	PIC#
	35 BOWDEN AVE	32,900		X	X	X	50 X 73	138
.REDUCE	2 DRIFTWOOD DR	54,800		X	X			139
	209 WASHINGTON RD	58,500		X	X	X		145
	152 RUMSTICK RD	74,900	X				125 X 293	140
	168 RUMSTICK RD	78,000	X	X	X	X	100 X 182	141
...NEW.	6 BRIARFIELD RD	85,000	X	X	X	X		142
	60 RUMSTICK RD	96,000	X	X	X	X	IRREG	148
	32 NEW MEADOW RD	135,000	X		X	X	246 X 328	146
	71 WATER WAY	175,000	X	X	X	X		143
	41 NAYATT RD	200,000	X	X	X	X	76300 SQ F	149
	61 CLARKE RD	235,000	X	X	X	X	182 FT	147
	343 RUMSTICK POINT RD	300,000	X	X		X	IRR	144

Exhibit 3

REALTRONICS DATA CORPORATION

Current Listing Index, Alphabetical Arrangement

09/14/73

MULTI LIST NUMBER	STREET ADDRESS	AREA	MAP COORDINATE 1	MAP COORDINATE 2			PRICE	EQUITY	BROKER	CONTACT NAME	PAGE NUMBER	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
90560	17554 INDIANA	01	1999	1677	84	4	27,500	27,500	799	BROKER	721		X	X	X	X		X					X	X		
93242	18297 INDIANA	01	1999	1677	62	3	28,500	12,500	863	TOWNES	167		X	X	X	X		X	X							
94454	19154 INDIANA	01	1999	1667	44	3	23,000	23,000	761	GOLDFINGER	143		X	X				X								
83430	18014 JAMES COUZ	01	1889	1677	96		32,000	32,000	350	HACKADON	755															
95480	16815 JAMES COUZE	01	1899	1777	96		60,000	31,000	717	BROKER	761															
93759	17200 JAMES COUZE	01	1899	1677	35	2	28,000	28,000	307	LOUIS	166		X	X	X	X		X					X			
95694	18076 JAMES COUZE	01	1889	1677	96		8,000	8,000	947	BROKER	742															
86492	18500 JAMES COUZE	01	1889	1677	96		12,000	12,000	947	BROKER	744										X					
96240	19456 JAMES COUZE	01	1889	1667	96		25,000	25,000	947	BROKER	753															
88978	19316 JOMES COUZ	01	1889	1667	96		19,900	19,900	098	WILDE	749															
89573	17181 KENTUCKY	01	1999	1677	86	5	21,900	15,900	109	BAREN	705		X	X	X	X		X					X			
95697	18061 KENTUCKY	01	1999	1677	45	4	23,900	11,900	799	CAUDLE	150		X	X		X		X			X		X			
97560	19361 KENTUCKY	01	1999	1667	44	3	19,500	19,500	109	BARNSTEIN	104 NEW		X	X		X		X	X		X					
79215	16192 LASALLE	01	2991	1777	86	5	26,900	4,900	186	NICHOLS	720		X	X		X		X					X			
92764	18964 LAUDER	01	1889	1677	65	4	26,500	26,500	211	LAMPE	162		X		X	X		X	X				X	X		
89895	19324 LAUDER	01	1889	1677	44	4	32,000	7,000	109	LEAVELLE	171		X	X		X		X								
95844	19331 LAUDER	01	1889	1667	65	3	21,900	6,900	268	CHANG	129		X	X	X	X		X					X			
93467	20524 LAUDER	01	1889	1667	43	3	60,000	60,000	109	DEMARAIS	176		X	X		X		X					X			
92684	20129 LESURE	01	1889	1667	45	3	22,900	9,900	109	MACKIE	139		X		X	X							X			
91880	20531 LESURE	01	1889	1667	35	3	19,500	15,500	496	ROTH	101		X										X	X		
95833	16647 LILAC	01	1999	1777	12	2	15,100	2,100	745	DRAPER	36		X	X		X		X								
88649	16827 LILAC	01	1999	1777	52	3	17,900	3,900	268	LEWIS	70		X	X		X							X			
92004	16510 LITTLEFIELD	01	1899	1777	44	2	17,500	17,500	318	MACDONALD	65		X	X				X					X			
93772	16545 LITTLEFIELD	01	1899	1777	52	3	19,000	17,000	765	CARNEY	97		X	X		X	X	X					X			
94496	18066 LITTLEFIELD	01	1899	1677	61	3	22,500	8,500	186	PERKINS	136		X		X	X		X					X			
95724	16262 MANOR	01	1889	1777	65	3	21,000	21,000	314	AVECISIAN	120		X	X		X	X	X					X			
96940	16653 MARK TWAIN	01	1889	1777	66	3	25,500	25,500	098	SITTEGERM	159		X	X	X	X		X			X		X			
93453	18282 MARK TWAIN	01	1899	1677	45	4	27,500	15,500	186	WILLIAMS	165		X	X		X	X	X								
96389	18476 MARK TWAIN	01	1889	1677	44	3	21,900	2,900	186	CALHOUN	130		X	X		X		X			X		X			
91706	19430 MARK TWAIN	01	1889	1667	32	3	30,000	12,000	109	JOHNSON	170		X	X					X							
95995	19701 MARK TWAIN	01	1889	1667	43	2	19,500	19,500	314	MCDERMOTT	103		X	X		X		X			X		X	X		
91132	20485 MARK TWAIN	01	1889	1667	33	3	23,900	7,900	109	LUMPKIN	148		X	X				X					X			
93058	16620 MARLOWE	01	1889	1777	43	4	21,950	3,900	350	JOHNSON	131		X	X	X	X		X					X			
97767	16884 MARLOWE	01	1889	1677	43	3	22,900	22,900	314	MCVAY	NEW		X	X	X	X	X	X					X			
96711	16908 MARLOWE	01	1889	1777	52	3	20,500	8,500	268	PARDONNET	114		X	X	X	X		X					X			
97976	18275 MARLOWE	01	1889	1677	61	3	22,700	4,700	109	JOHNSON	NEW		X	X		X	X	X	X							
91255	18444 MARLOWE	01	1889	1677	66	3	23,900	10,900	109	LOWE	148		X	X	X	X	X	X	X				X			
97771	18619 MARLOWE	01	1889	1677	61	3	27,900	12,900	674	HILLS	NEW		X	X	X	X		X	X				X	X		
93466	18636 MARLOWF	01	1889	1677	65	3	24,500	18,500	109	LEONARD	153		X	X		X		X			X		X			
84314	19190 MARLOWE	01	1889	1667	52	4	35,900	19,900	109	DAVIS SR	172		X	X	X	X		X	X				X	X		
91196	19817 MARLOWE	01	1889	1667	46	2	30,000	24,000	863	SMITH	169		X	X	X	X		X	X				X			
93920	20036 MARLOWE	01	1889	1667	33	4	36,000	17,000	864	ADAMS	173		X		X	X	X	X					X			
97399	10235 MCNICHOLS	01	1899	1677	98		36,500	36,500	186	SILVER	780 NEW															
85832	10240 MCNICHOLS	01	1899	1677	96	2	15,900	15,900	959	BROKER	746					X	X				X					
97963	10235 MCNICHOLS W	01	1899	1677	96		47,000	47,000	186	NEMEN	NEW															
96833	10241 MCNICHOLS W	01	1899	1677	98		25,900	25,900	186	BUNIN	779															
95071	15320 MCNICHOLS W	01	1889	1677	96		50,000	50,000	109	GELTNER	760															
89839	17343 MENDOTA	01	1899	1677	65	3	23,000	23,000	350	CLARK	142 PC		X	X		X	X	X	X							
92925	17410 MENDOTA	01	1899	1677	65	3	22,900	11,900	666	HARRISON	139		X	X	X	X		X					X	X		
93457	19185 MENDOTA	01	1899	1667	62	3	23,200	23,200	552	TABOCK	144		X	X	X	X		X	X				X			
96694	19339 MENDOTA	01	1899	1667	52	3	27,900	14,900	761	JACKSON	166		X	X		X		X	X				X			
92302	20490 MENDOTA	01	1899	1667	15	3	18,500	9,500	350	DAVISION	85		X	X	X											
90642	16591 MEYERS	01	1899	1777	96		60,000	60,000	110	BROKER	761										X					
93460	18236 MEYERS	01	1899	1677	81	4	30,000	28,000	195	USHEA	728		X	X		X					X					
91380	19325 MEYERS	01	1899	1667	82	2	16,000	2,000	268	BRADFORD	673		X		X	X							X			
95323	19447 MEYERS	01	1889	1667	81	2	16,900	16,900	251	JEZIORO	677		X			X										
97390	19937 MEYERS	01	1899	1667	81	2	13,900	13,900	350	GUVEN	667 NEW		X	X		X							X			
96829	20521 MEYERS	01	1899	1667	81	2	11,000	11,000	268	BROKER	657		X	X							X					
89820	16255 MONICA	01	1999	1777	10	2	16,900	16,900	366	BROKER	54 PC		X	X		X					X		X			
90803	16596 MONICA	01	1999	1777	27	3	16,950	16,900	494	DE CARLO	59 PC		X			X							X			
93469	16917 MONICA	01	1999	1777	86	1	31,500	23,500	109	HOWARD	728		X		X	X		X					X			
97520	17304 MONICA	01	1999	1677	52	3	23,900	23,900	350	NAGEL	151 NEW		X	X	X	X		X		X			X			
92607	20428 MONTEVISTA	01	1899	1667	03	3	17,900	15,900	733	CURTIS	72		X			X										
90926	16835 NORMANDY	01	2991	1777	54	4	26,000	6,000	674	MILES	161		X	X	X	X	X	X					X			
87479	18600 NORTHLAWN	01	1999	1677	65	4	27,000	16,000	186	GAMBRELL	164		X	X	X	X	X	X	X				X			
92883	20191 NORTHLAWN	01	1999	1667	43	4	21,500	21,500	863	DEVAULL	123		X			X							X			
94876	6875 OUTER DR	01	1889	1677	46	3	28,000	28,000	366	LOOMAN	166		X	X	X	X		X			X		X			
91503	3867 OUTER DR W	01	1999	1667	65	3	33,500	13,500	186	SIMPSON	171		X	X	X	X		X	X				X	X		
93753	5112 OUTER DR W	01	1899	1677	65	3	35,000	35,000	761	CORBY	172		X	X	X	X		X	X				X	X		
97942	5252 OUTER DR W	01	1899	1677	61	3	29,900	7,900	761	NUNNERY	NEW		X	X	X	X		X					X	X		
96931	6122 OUTER DR W	01	1889	1677	65	4	37,650	18,600	540	BRUTON	173		X		X	X	X	X					X			
95766	16540 PARKSIDE	01	2991	1777	66	4	19,900	19,900	786	CHANCE	107		X	X		X		X					X			
88363	19225 PARKSIDE	01	2991	1667	65	4	39,500	28,500	186	LOCKMAN	174		X	X	X	X	X	X					X	X		
96677	18714 PELKEY	01	1899	1677	83	3	16,500	2,500	863	ROJAST	676		X			X										
97711	8751 PEMBROKE	01	1999	1667	82	3	19,500	12,500	109	WATKINS	694 NEW		X		X	X										
83821	12928 PEMBROKE	01	1899	1667	61	3	20,900	20,900	195	ROURKE	115		X	X	X	X		X					X	X		
94218	17601 PENNINGTON	01	1999	1677	65	3	24,500	5,500	350	TAYLOR	153		X	X	X	X		X					X			
93425	18939 PENNINGTON	01	1999	1677	52	3	25,000	25,000	366	BENNETT	157		X	X		X	X	X					X	X		
93245	18967 PENNINGTON	01	1999	1677	52	3	24,500	5,500	863	HARRIS	152		X	X	X	X		X					X			
88825	19943 PENNINGTON	01	1999	1667	44	3	20,000	14,000	109	WARP	110		X			X										
97405	16521 PINEHURST	01	1899	1777	62	3	24,000	7,000	109	HARRIS	152 NEW		X			X	X						X			
64792	18261 PINEHURST	01	1899	1677	44	2	21,500	20,500	109	OLDEN	122		X	X		X		X					X			
91097	18645 PINEHURST	01	1899	1677	52	3	25,500	25,500	553	PALIEVITZ	158		X		X	X		X					X			
89250	18661 PINEHURST	01	1899	1677	62	3	21,900	21,900	941	HEDDLE	126		X	X	X	X		X								

FEATURES

11 BRAND NEW HOMES
12 BASEMENT
13 KITCHEN TABLE SPACE OR CINETTE
14 GRADE LAV
15 DINING ROOM
16 MORE THAN ONE BATH
17 FIREPLACE
18 FAMILY ROOM
19 DEN AND LIBRARY
20 IMMEDIATE OCCUPANCY
21 LARGE LOTS, HALF ACRE
22 GARAGE
23 PASS HALL
24 SWIMMING POOL
25 WATERFRONT OR WATER PRIVILEGE

Exhibit 4

REALTRONICS DATA CORPORATION

Rhode Island Weekly Statistical Report, Week 20

NUMBER OF ACTIVE LISTINGS	1,762	VOLUME $	75,554,267
NUMBER OF NEW LISTINGS	171	VOLUME $	7,052,510
NUMBER OF SOLD THIS WEEK	50	VOLUME $	1,642,850
NUMBER OF PENDING THIS WEEK	83	VOLUME $	2,993,150
NUMBER OF SOLD YEAR TODATE	857	VOLUME $	27,836,105
NUMBER OF PENDING YEAR TODATE	765	VOLUME $	27,805,000

CO-OP 27.6 PERCENT LIST BROKER 72.4 PERCENT

AVERAGE MARKET TIME

	DAYS		AVE. MKT PRICE
SOLD	17	$	32,480
PENDING	63	$	36,346
NOT SOLD BUT OFF MARKET	111	$	41,601
ACTIVE	69	$	42,879

AVERAGE PRICE ACTIVE LISTINGS RESIDENTIALS ONLY

BEDROOMS	NUMBER	AVE. MKT PRICE	AVE. DAYS ON MKT
2	136	$ 30,483	74
3	680	$ 38,779	61
4	414	$ 46,394	62
5+	208	$ 55,374	81

Exhibit 5

REALTRONICS DATA CORPORATION

Realtron Expirations during Week

BOARD 101

DATE 09/14/73

MULTI LIST NUMBER	STREET ADDRESS	AREA	MAP COORDINATE 1	MAP COORDINATE 2			PRICE	TERMS		DATE SOLD	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
87541	20028 GREENLAWN	01	1999	1667	33	3	22,500	EXP	863	09/03/73		X			X										
90636	20175 HUBBELL	01	1889	1667	34	3	27,000	EXP	109	09/03/73		X	X				X					X			
78406	20429 KENTUCKY	01	1999	1667	02	4	13,500	EXP	110	09/07/73					X										
88257	16227 LASALLE	01	2991	1677	61	3	20,900	EXP	109	09/09/73		X	X	X	X		X					X			
90901	19858 LAUDER	01	1889	1667	32	3	19,500	EXP	432	09/05/73		X			X										
87898	16538 LITTLEFIELD	01	1899	1777	43	3	22,500	EXP	307	09/06/73		X	X	X	X							X			
78214	13138 LONGVIEW	01	0000	0098	84	3	28,000	EXP	109	09/06/73		X			X		X					X			
87792	18672 NORTHLAWN	01	1999	1677	52	3	28,000	EXP	109	09/04/73		X		X	X		X					X			
94948	03300 OUTER DR W	01	1999	1667	35	3	37,900	EXP	109	09/06/73		X			X		X	X				X			
90967	08751 PEMBROKE	01	1999	1667	82	3	20,500	EXP	109	09/05/73		X		X	X										
90908	17580 PENNINGTON	01	1999	1677	62	3	24,000	EXP	327	09/07/73		X	X	X	X		X					X	X		
78579	17156 PINEHURST	01	1899	1677	41	2	19,500	EXP	109	09/09/73		X					X					X			
94257	18620 PREST	01	1889	1677	43	4	22,900	EXP	109	09/05/73		X	X	X	X		X					X	X		
94253	19743 ROBSON	01	1889	1667	36	3	39,500	EXP	109	09/04/73		X	X	X	X		X	X				X			
87611	16642 SANTA ROSA	01	1999	1777	84	4	23,500	EXP	110	09/02/73		X			X							X			
90972	20524 SCHAEFER	01	1889	1667	98		45,000	EXP	109	09/03/73															
90793	16140 SORRENTO	01	1899	1777	04	3	21,000	EXP	863	09/05/73			X	X	X			X							
84010	17606 SORRENTO	01	1899	1677	61	3	23,500	EXP	109	09/04/73		X	X	X	X		X								
91486	20400 STANSBURY	01	1889	1667	44	3	24,000	EXP	350	09/09/73		X							X			X	X		
87881	16531 SUSSEX	01	1889	1777	44	3	20,900	EXP	149	09/06/73		X			X		X								
84924	19460 SUSSEX	01	1889	1667	44	3	20,900	EXP	109	09/08/73		X	X		X										
94455	03350 7 MILE	01	2991	1667	58	4	55,000	EXP	761	09/06/73		X	X	X	X		X	X				X	X		
88070	08133 8 MILE W	01	1999	1667	96		17,500	EXP	186	09/07/73															
84495	06330 ANNLAND	02	1999	1888	12	4	14,700	EXP	782	09/05/73		X	X	X	X							X			
87544	08266 APPOLINE	02	1899	1889	44	3	24,900	EXP	942	09/02/73		X	X				X					X			
91378	14345 ARDMORE	02	1889	1778	04	2	17,500	EXP	098	09/09/73		X	X									X			
90959	10080 BEECHDALE	02	1899	1888	52	2	18,900	EXP	401	09/04/73		X	X				X					X			
78877	BURNETT	02	1999	1888	95		7,000	EXP	145	09/09/73											X				
84882	09399 BURNETTE	02	1999	1888	24	3	15,500	EXP	864	09/08/73		X			X							X			
88041	08217 CARLIN	02	1889	1889	23	3	20,500	EXP	745	09/07/73		X	X		X		X					X			
88245	15955 CHALFONTE	02	1889	1778	12	4	15,900	EXP	563	09/06/73		X	X		X							X			
90602	09200 CHEYENNE	02	1899	1888	44	3	19,500	EXP	098	09/03/73		X	X		X							X			
90577	15301 CHICAGO W	02	1889	1888	82	2	16,000	EXP	164	09/02/73		X	X		X										
90578	15305 CHICAGO W	02	1889	1888	82	2	16,000	EXP	164	09/02/73		X	X		X										
90579	15331 CHICAGO W	02	1889	1888	82	2	16,000	EXP	164	09/02/73		X	X		X										
90580	15335 CHICAGO W	02	1889	1888	82	2	16,000	EXP	164	09/02/73		X	X		X										
78371	12053 COYLE	02	1889	1788	44	2	20,500	EXP	186	09/07/73		X	X		X		X					X	X		
84759	12687 COYLE	02	1889	1788	12	2	15,900	EXP	825	09/09/73		X	X									X			
88239	14155 COYLE	02	1889	1778	86	4	20,500	EXP	211	09/09/73		X	X		X	X					X	X			
77896	07681 ELLSWORTH	02	1999	1778	02	2	11,500	EXP	332	09/06/73		X	X		X							X			
91108	09975 FREELAND	02	1889	1888	42	3	18,900	EXP	729	09/06/73						X									
84133	03830 FULLERTON	02	1999	1788	52	3	24,500	EXP	307	09/02/73		X	X	X	X		X					X	X		
78303	14906 GRAND RIVER	02	1889	1778	96		19,900	EXP	799	09/08/73															
88078	15743 GREENVIELD	02	1889	1777	82	2	16,200	EXP	552	09/07/73		X	X		X										
88248	15078 GRIGGS	02	1899	1778	15	3	12,500	EXP	406	09/04/73			X												
92879	12776 HARTWELL	02	1899	1788	22	4	13,900	EXP	674	09/04/73		X	X		X	X	X			X		X			
91374	12251 ILENE	02	1899	1788	12	3	17,500	EXP	098	09/09/73		X	X	X	X		X					X			
87540	14154 ILENE	02	1899	1788	04	2	13,000	EXP	863	09/02/73		X			X							X			
87777	11708 KENTUCKY	02	1999	1788	44	3	15,900	EXP	268	09/04/73		X	X		X		X					X			
87909	08539 LAUDER	02	1889	1889	52	2	18,500	EXP	405	09/05/73		X	X		X		X					X			
78327	09974 LAUDER	02	1889	1888	03	3	15,900	EXP	266	09/07/73			X												
90806	11707 LAUDER	02	1889	1788	14	3	16,500	EXP	666	09/07/73		X	X							X		X			
87454	13958 LAUDER	02	1889	1778	53	4	20,500	EXP	164	09/04/73		X	X		X		X					X			
88059	10014 LITTLEFIELD	02	1899	1888	46	3	25,900	EXP	211	09/07/73			X		X		X					X			
78400	14518 LITTLEFIELD	02	1899	1778	44	3	20,500	EXP	109	09/08/73		X			X		X	X							
94347	15778 MANOR	02	1899	1777	84	4	19,000	EXP	350	09/04/73		X	X		X		X					X			
88508	15516 MARK TWAIN	02	1889	1777	86	4	23,500	EXP	307	09/09/73		X	X		X							X			
90896	15350 MARLOWE	02	1889	1777	83	3	18,000	EXP	863	09/05/73		X	X		X	X						X			
88072	08127 MECCA	02	1889	1788	98		30,000	EXP	186	09/07/73															
88071	13786 MECCA	02	1889	1788	45	3	20,000	EXP	781	09/07/73		X	X		X			X							
87558	08876 MEYERS	02	1899	1888	86	4	21,900	EXP	263	09/04/73		X	X		X							X			
81165	10245 MONICA	02	1999	1888	88	5	86,000	EXP	109	09/03/73		X													
87740	14571 NORTHLAWN	02	1999	1778	14	3	14,900	EXP	448	09/06/73		X	X							X					
78690	11383 OHIO	02	1999	1888	22	4	15,500	EXP	211	09/07/73		X	X	X	X	X	X					X			
78316	14295 OHIO	02	1999	1778	33	2	16,500	EXP	098	09/07/73		X	X		X										
78332	13981 PINEHURST	02	1899	1778	12	2	9,900	EXP	765	09/07/73			X									X			
87878	14137 PINEHURST	02	1899	1778	22	4	14,500	EXP	663	09/07/73		X	X	X	X							X			
84591	10455 PLYMOUTH	02	1899	1888	11	3	15,000	EXP	350	09/05/73		X	X		X		X					X			
87907	08211 PREST	02	1889	1889	44	3	21,900	EXP	474	09/06/73		X	X		X		X			X		X			
78551	07601 PURITAN	02	1999	1777	96		75,000	EXP	350	09/08/73															
87553	13346 SCHOOLCRAFT	02	1899	1788	84	4	16,900	EXP	675	09/02/73		X	X		X		X					X			
88044	14828 SNOWDEN	02	1899	1778	14	2	16,500	EXP	398	09/06/73		X	X		X		X					X			
87778	09163 SORRENTO	02	1899	1888	24	3	13,900	EXP	268	09/05/73		X	X		X		X					X			
90970	09110 STEEL	02	1899	1888	33	3	18,000	EXP	109	09/05/73			X									X			
88032	09936 SUSSEX	02	1889	1888	33	2	17,500	EXP	191	09/07/73		X	X									X			
91096	14512 SUSSEX	02	1889	1778	51	4	18,750	EXP	328	09/06/73		X	X	X	X					X					
87595	09426 TERRY	02	1889	1888	04	3	16,900	EXP	211	09/04/73		X	X									X			
87575	15738 WARD	02	1899	1777	14	3	18,900	EXP	165	09/04/73					X		X					X			
88240	13135 WASHBURN	02	1899	1788	24	3	16,500	EXP	211	09/07/73		X	X		X	X	X					X			
91357	00120 WHITCOMB	02	1889	1778	91		3,000	EXP	327	09/09/73															
88030	11716 WHITCOMB	02	1889	1788	32	2	16,900	EXP	604	09/08/73		X	X							X					

FEATURES

11 BRAND NEW HOMES
12 BASEMENT
13 KITCHEN TABLE SPACE OR DINETTE
14 GRADE LAV
15 DINING ROOM
16 MORE THAN ONE BATH
17 FIREPLACE
18 FAMILY ROOM
19 DEN AND LIBRARY
20 IMMEDIATE OCCUPANCY
21 LARGE LOTS, HALF ACRE
22 GARAGE
23 PASS HALL
24 SWIMMING POOL
25 WATERFRONT OR WATER PRIVILEGI

While ideally, the computer-generated reports would be included in the "perfect-bound" photo-listing book, RDC found it difficult to coordinate the computer reporting and the printing work in the 48-hour turn-around time requirement. Consequently, RCD used a Xerox 7000 to reduce the computer listings to 8-1/2" x 11", and sent them loose-leaf with the bound photo listings. Including both the computer reports and the photo-listings, an average book was 400 pages, although some books during the active summer months approached 1,000 pages.

In addition to the weekly books, RDC provided a cumulative "comparable" book on a quarterly and annual basis. These "comp" books included the same computer reports and photo-listings as the weekly books. Realtors used them as a reference guide to establish bench marks of value and to point out market comparisons to their clients. Using the street listing, for example, a realtor could drive down any street in his market area and quickly point out the selling price of every house on that street for the last year, provided the house was sold through MLS (Exhibit 6).

RDC charges for its services on a per-book basis. The rate schedule in effect in 1974 was as follows:

# Books per week	Price per book
80-100	$6.00
101-200	4.70
201-300	4.20
301-400	3.90
401-500	3.70
501-600	3.60
601-700	3.50
701-800	3.40
801-900	3.30
over 1000	3.20

Annual revenue per MLS board ranged from $30,000 to over $100,000. A typical board might have 400 members and pay $80,000 per year, monitoring 1500 active listings. About 10% of these listings were sold, expired, or withdrawn each week.

Exhibit 6

REALTRONICS DATA CORPORATION

Cumulative Index Sold, Expired & Withdrawn

09/14/73

MULTI LIST NUMBER	STREET ADDRESS	AREA	MAP COORDINATE 1	MAP COORDINATE 2		BEDR	PRICE	TERMS	SELL. NO. BROKER	DATE SOLD	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
87480	07500 PEMBROKE	01	1999	1667	38	3	30,000	C	186	07/16/73		X	X	X	X		X	X		X		X			
87612	08531 PEMBROKE	01	1999	1667	37	3	29,900	C	781	07/10/73		X	X									X			
90967	08751 PEMBROKE	01	1999	1667	82	3	20,500	EXP	109	09/05/73		X		X	X										
90908	17580 PENNINGTON	01	1999	1677	62	3	24,000	EXP	327	09/07/73		X	X	X	X		X					X	X		
86518	17601 PENNINGTCN	01	1999	1677	54	3	24,500	EXP	110	07/22/73		X	X	X	X		X					X			
71607	18967 PENNINGTON	01	1999	1677	52	3	23,500	EXP	498	07/06/73		X	X	X	X		X					X			
72527	19131 PENNINGTON	01	1999	1677	51	3	21,900	EXP	110	07/15/73		X	X		X		X					X			
88332	19451 PENNINGTCN	01	1999	1667	43	3	18,900	F	332	09/11/73		X										X			
86373	16521 PINEHURST	01	1899	1777	61	3	24,000	EXP	109	08/22/73		X			X	X									
78579	17156 PINEHURST	01	1899	1677	41	2	19,500	EXP	109	09/09/73		X					X					X			
90470	17548 PINEHURST	01	1899	1677	45	4	21,500	L	350	08/23/73		X	X		X	X	X	X							
88996	18669 PINEHURST	01	1999	1677	65	3	23,500	EXP	552	08/15/73		X	X		X		X					X			
87538	20178 PINEHURST	01	1899	1667	12	2	16,500	EXP	863	08/21/73		X	X												
84115	16186 PRAIRIE	01	1999	1777	06	1	11,950	EXP	164	08/02/73		X	X		X										
87100	16657 PRAIRIE	01	1999	1777	83	4	13,100	A	211	07/21/73		X	X		X							X			
90461	18218 PRAIRIE	01	1999	1677	52	3	19,500	G	109	08/06/73		X	X		X							X			
79464	20232 PRAIRIE	01	1999	1667	06	2	13,500	EXP	233	09/13/73		X													
85565	16145 PREST	01	1889	1777	65	3	20,000	C	109	07/13/73		X	X	X	X		X						X		
88799	16193 PREST	01	1889	1777	65	3	24,900	EXP	186	08/13/73		X	X	X	X		X					X			
85033	16210 PREST	01	1889	1777	61	3	26,900	EXP	432	08/09/73		X	X	X	X		X					X	X		
93792	16850 PREST	01	1889	1777	44	3	19,500	F	572	08/14/73		X	X		X		X					X			
86014	16876 PREST	01	1889	1777	44	3	23,000	A	863	07/31/73		X	X	X	X		X					X			
93305	18020 PREST	01	1889	1677	44	4	22,500	C	633	09/05/73		X	X		X		X					X			
87798	18620 PREST	01	1889	1677	84	3	26,900	EXP	109	08/05/73		X	X	X	X	X	X					X	X		
94257	18620 PREST	01	1889	1677	43	4	22,900	EXP	109	09/05/73		X	X	X	X		X					X	X		
85877	18685 PREST	01	1889	1677	44	3	18,000	F	674	07/03/73		X	X		X		X			X					
71367	18949 PREST	01	1889	1677	43	4	24,000	EXP	110	07/03/73		X	X		X	X	X					X			
83814	19700 PREST	01	1889	1667	34	3	21,900	EXP	611	07/27/73		X	X		X							X			
75123	19720 PREST	01	1889	1667	44	2	18,500	EXP	307	08/05/73		X	X												
85715	17411 QUINCY	01	2991	1677	86	3	23,500	EXP	402	07/14/73		X	X		X	X	X					X			
82284	16549 ROBSON	01	1889	1777	24	3	17,400	EXP	447	07/16/73		X	X		X							X			
92930	16570 ROBSON	01	1889	1777	44	3	19,000	A	098	08/02/73		X	X		X		X			X		X			
89812	16876 ROBSON	01	1889	1777	45	3	21,500	EXP	863	08/01/73		X	X	X	X		X								
89812	16876 ROBSON	01	1899	1777	45	3	21,000	C	863	08/02/73		X	X	X	X		X								
77895	18203 ROBSCN	01	1889	1677	43	3	22,000	C	332	07/14/73		X	X		X		X					X			
77895	18203 ROBSON	01	1889	1677	43	3	23,900	EXP	332	07/03/73		X	X		X		X					X			
90890	18256 ROBSCN	01	1889	1677	44	3	20,000	C	366	08/11/73		X	X		X		X					X			
91229	18965 ROBSON	01	1889	1677	47	2	19,300	F	268	09/04/73		X			X	X	X			X		X			
86185	19337 ROBSON	01	1889	1667	43	2	20,500	A	674	07/30/73		X	X		X		X					X			
87195	19743 ROBSON	01	1889	1667	36	3	41,500	EXP	799	07/31/73		X		X	X										
94253	19743 ROBSON	01	1889	1667	36	3	39,500	EXP	109	09/04/73		X	X	X	X		X	X				X			
88090	19990 ROBSON	01	1889	1667	38	4	57,000	EXP	110	08/30/73		X	X			X	X	X				X	X		
95191	16127 ROSELAWN	01	1999	1777	51	3	19,000	C	268	08/22/73		X	X	X	X		X					X			
88034	17167 ROSELAWN	01	1999	1677	84	4	21,900	F	186	07/14/73		X			X							X			
86604	19366 ROSELAWN	01	1999	1667	52	3	19,900	EXP	498	08/25/73		X			X		X			X		X			
92623	13557 ROSEMONT	01	1788	1788	32	3	20,500	F	941	08/23/73		X	X		X							X			
76111	19703 SAN JUAN	01	1999	1667	44	4	18,850	EXP	109	08/09/73		X	X		X		X								
79463	17385 SANTA BARB	01	1999	1677	54	3	21,000	EXP	233	09/10/73		X	X	X	X	X	X	X							
89268	18111 SANTA BARB	01	1999	1677	52	5	43,000	EXP	401	07/22/73		X	X		X		X					X	X		
92624	18304 SANTA BARB	01	1999	1677	62	3	24,900	W/D	941			X		X	X	X	X					X			
77912	19969 SANTA BARBA	01	1999	1667	14	2	17,900	EXP	350	07/03/73		X	X												
87611	16642 SANTA ROSA	01	1999	1777	84	4	23,500	EXP	110	09/02/73		X			X							X			
79757	16841 SANTA ROSA	01	1999	1777	24	3	16,900	F	268	07/05/73		X	X		X		X					X			
85287	18695 SANTA ROSA	01	1999	1677	53	3	20,900	EXP	268	07/11/73		X	X	X	X		X					X			
87292	19215 SANTA ROSA	01	1999	1667	62	5	36,900	EXP	109	08/31/73		X	X		X	X		X				X			
90254	19994 SANTA ROSA	01	1999	1667	52	3	19,500	EXP	572	08/31/73		X	X		X		X					X			
82278	16151 SCHAEFER	01	1889	1777	12	5	12,900	EXP	694	08/17/73		X	X	X	X			X				X			
92262	18010 SCHAEFER	01	1899	1677	82	2	22,900	L	268	08/15/73		X			X	X									
89891	19436 SCHAEFER	01	1899	1677	82	2	14,900	A	552	07/02/73		X			X										
81337	19782 SCHAEFER	01	1889	1667	82	2	14,900	EXP	782	07/05/73		X			X					X					
90972	20524 SCHAEFER	01	1889	1667	98		45,000	EXP	109	09/03/73															
72396	20530 SCHAEFER	01	1899	1667	98		5,000	EXP	186	07/12/73															
87771	16189 SCHAEFFER	01	1889	1777	59	1	6,000	W/D	420			X	X												
86667	08441 SEVEN MILE	01	1999	1677	61	3	21,900	EXP	268	08/25/73		X	X	X	X		X					X			
82941	16206 SNOWDEN	01	1899	1777	52	3	16,900	EXP	268	07/20/73		X	X		X										
95375	16840 SNOWDEN	01	1899	1777	65	3	23,900	W/D	110			X	X	X	X		X					X	X		
90798	16927 SNOWDEN	01	1899	1777	61	3	22,900	EXP	717	09/13/73		X	X	X	X							X			
86971	17207 SNOWDEN	01	1899	1677	52	3	21,900	EXP	109	07/29/73		X	X		X		X					X			
92754	17559 SNOWDEN	01	1899	1677	52	2	16,200	F	531	08/27/73		X	X		X			X							
77907	18411 SNOWDEN	01	1899	1677	18	2	16,900	C	666	08/07/73		X	X		X		X					X			
90496	18442 SNOWDEN	01	1899	1677	45	3	20,900	W/D	485			X	X		X		X					X			
96728	18442 SNOWDEN	01	1899	1677	45	3	20,500	F	863	09/10/73		X	X	X	X		X					X			
92167	18651 SNOWDEN	01	1899	1677	47	3	22,900	G	799	07/27/73		X	X	X	X	X	X					X			
89825	19140 SNOWDEN	01	1899	1677	66	3	24,900	EXP	496	09/01/73		X	X	X	X		X					X			
92928	19769 SNOWDEN	01	1899	1667	52	3	26,000	C	307	07/25/73		X	X	X	X		X	X				X			
90793	16140 SORRENTO	01	1899	1777	04	3	21,000	EXP	863	09/05/73			X	X	X			X							
86346	16830 SORRENTO	01	1899	1777	65	3	20,500	EXP	941	08/23/73		X	X	X	X		X					X			
86935	16835 SORRENTO	01	1899	1777	84	5	23,000	C	761	07/02/73		X	X		X		X					X			
84010	17606 SORRENTO	01	1899	1677	61	3	23,500	EXP	109	09/04/73		X	X	X	X		X								
89107	19351 SORRENTO	01	1899	1667	52	3	23,400	A	863	07/09/73		X	X	X	X		X					X	X		
92296	16170 STANSBURY	01	1889	1777	27	3	17,900	F	332	09/10/73		X	X		X	X				X		X			

SELECTION OF A SERVICE BUREAU

When Alden was setting up RDC in 1969, his choice of a printer to create the weekly listing photo book was no problem. Mr. Luther Brown, owner of one of Providence's largest printing companies, had invested $50,000 for a 15% equity interest in RDC. Each week, RDC would send a set of "camera-ready" listing cards to Mr. Brown for offset printing and binding. The listing cards were prepared by each MLS board, and included a photograph and full description of each property. An RDC employee spent about two hours to manually arrange the listing cards for each board in the proper order, adding all new listings, and removing all those sold, expired, or withdrawn. Before sending the cards to Mr. Brown, RDC made a Xerox copy of each new listing card as a source document for data entry to the computer. The "key-stroking" time for one board would run some four hours a week.

Choosing someone to perform the computer work was not as simple. Alden decided that a service bureau which offered both programming and operation would be advisable at first. He felt that RDC should handle the input itself rather than depending on another company to keypunch the data submitted by real estate boards. He had heard about "garbage in, garbage out," and wanted to have absolute control over what went into the computer.

The critical element in selection of a service bureau was turn-around speed. RDC could not afford to wait even one day for computer processing. Once the data was keypunched, most large computers could edit, sort, and list the data for several boards in less than two hours.

After speaking with several service bureaus, Alden selected JTJ Services, a two-year-old company specializing in mailing lists and computer letters. John T. Johnson, founder and president of JTJ, had been a classmate of Alden's in business school, and Alden felt comfortable dealing with someone he knew. JTJ had plenty of open time on its computer, and agreed to set aside time every Friday evening to run RDC's work. All MLS listings received by RDC in Friday's mail could be keypunched on Friday, run on the computer Friday night, and printed and mailed Saturday. The real estate boards could plan on having their computer reports on Monday morning each week along with the photo listing book. JTJ agreed to write the programs for $2,500, and estimated that the work would cost about $400-$500 per month.

JTJ used an IBM 370, and had developed a machine that would convert paper tape to magnetic tape. Since Alden had purchased a used Friden Flexowriter (paper tape machine) to write "automatic" sales letters to real estate boards, he would not have to invest in keypunch equipment. Instead he could use the paper tape generated by the Friden as input for the IBM 370.

For the first three months, everything went smoothly with JTJ. Then serious problems developed. On two occasions, the paper tape that controlled the Friden Flexowriter became worn, and omitted some characters which were needed to instruct the computer that a field had ended. Unfortunately, this problem could not be detected by the operator, as the information typed on the keyboard was correct. The entire job had to be re-keypunched both times, and reports were several days late.

Another time, the paper tape converter broke down, and the JTJ employee who had fabricated this machine was on vacation (since JTJ had developed this converter themselves, it was not serviced by an outside company). Two of the three MLS boards RDC serviced at that time threatened to cancel their contract if RDC could not deliver a more consistent service.

The final straw came in August, 1970 when JTJ secured a computer letter contract with a national magazine. For six consecutive days, nothing else was run on the computer. Upon learning of the situation, Alden became quite upset, and went to see Johnson in person. While Johnson was sympathetic with Alden's problem, he explained that the magazine contract was worth more than what Alden would pay him in ten years. He suggested that Alden find another, smaller service bureau. JTJ expected to get some even larger computer letter contracts in the near future, and could not guarantee the one-day turn-around any longer.

RENTING TIME

Alden had heard great things about the IBM System 3, and had visited a recent installation in a restaurant where he often had lunch. Ed Lapini, the controller of the restaurant, had set up a separate corporation (Tronics-Datum) to sell computer services to other restaurants. He had called on Alden several weeks before the final straw at JTJ, and had assured Alden that RDC could rent his computer every Friday night for only $12.00 per hour.

Since Tronics-Datum had a card system (as opposed to a disk or tape system), the computer would take about five hours a week to handle RDC's current volume of 5 boards. It would cost only $900 to program all of RDC's work, and Lapini could get the system up and running in less than a week. The only hitch was that RDC would have to lease an IBM 96 column data recorder for $160 per month, and have its own computer operator.

Alden was disgusted with paper tape at this point; and liked the added control of having his own operator. He signed a one-year contract with Tronics-Datum, agreeing to use at least 20 hours of computer time each month.

At the end of 1970, Alden had to produce the annual recapitulations of all the data. Since the records processed by JTJ were on magnetic tape, and the balance were on 96 column cards, the tape would have to be converted to cards. At the time, IBM's System 3 did not have the capability to read magnetic tape, so 40,000 records had to be converted from tape to 80-column cards (2 cards per record) and these re-punched to 96 column cards. An outside service bureau, Datops, Inc., charged $1,000 to punch the 80 column cards. Alden and his production manager spent several nights at the IBM service center punching out the 96 column cards and sorting them. Alden did not discover that the magnetic tape was not in the correct alphabetical order until after the 80 column cards were punched out. It took over 40 hours of computer time at $18.75 per hour to perform the 28-column sort on 80,000 cards, and an equal amount of time to punch the 96 column cards.

The 1970 annual recapitulation was not delivered until the end of February. Fortunately for Alden, the weekly photo listing book was going out consistently on time, and no customers threatened to discontinue.

On July 19, 1971, Lapini called up Alden and said, "IBM's coming tomorrow to take the computer--we have not paid them for several months. If you can arrange to lease the computer yourself, we'll use it for one shift and pay you half the $1300 monthly rental. Otherwise we are going out of business." Alden was shocked! He had hardly thought about the computer for several months. He now had eight real estate boards under contract, and his monthly computer bill was running about $700, plus an operator. The IBM salesman, while trying to transfer Tronics-Datum's machine to RDC, recommended that Alden really needed a disk system

($1800 per month) to handle the increasing number of records. Alden was unwilling to commit for this amount, especially since he doubted Tronics-Datum's continued existence. Instead, the IBM salesman recommended Acimeter Corp., a manufacturing company less than 10 miles away with available time on their disk-operated System 3. The price was $16.00 per hour, and the running time would almost be cut in half. Alden hired a moonlighter who converted all the programs to the disk system for less than $500.

The arrangement with the Acimeter worked well for almost one year. RDC's monthly bill increased to $1200, and another $700 was being spent Xeroxing multiple copies of the computer listings. As new customers were added on, however, RDC needed more computer time than was available on the day shift. Acimeter, due to government classified work it performed, could not allow RDC in their building after 6:00 p.m. when its classified employees went home.

AN IN-HOUSE SYSTEM

To meet its expanding needs for computer service, RDC ordered its own disk-operated System 3 in August, 1972. In order to help justify the system, Alden planned to have the computer print individual reports each week for every subscribing broker. (The broker's name was to be printed in the corner of each page, a personal touch which later caused many favorable comments from customers.) Since the computer was a fixed cost, Alden figured that the incremental cost of printing individual listings on the computer was negligible, especially when it would run for hours virtually unattended, and would eliminate the need for Xeroxing the computer reports.

Alden soon learned that the monthly rental was not the only significant cost of a computer. After ordering the System 3, he discovered that a required electrical installation would cost $800. The monthly electric bill for the computer was $300. Each new real estate board required a new $130 removable disk. (Some larger boards required one disk for each year's data, and wanted 3 or 4 years' historical data in storage.) As the number of boards increased, a second shift was added, and then a faster printer (adding $600 to the monthly cost).

Partly to help cover the increased cost of the computer, Alden offered computer services to several business acquaintances who came to him when they heard that he had

a computer. John Johnson even sent over a few customers that were too small for JTJ. In February, 1973, Alden hired a full-time RPG II programmer, at a $10,000 annual salary. By April, RDC was doing payrolls, mailing list maintenance, accounts receivable, mortgage reduction tables (for another company serving the real estate industry), and a sophisticated customer follow-up and mailing program for automobile dealers.[1]

A SERVICE BUREAU

At the end of 1973, Alden took a critical look at his company. In its three years of operation, it had yet to make a profit. In 1973, he had sales of over $800,000, but a loss of over $60,000. The investors were putting considerable pressure on Alden to start making a profit, and he felt they were unwilling to finance any more losses. Both sales and the loss were higher than ever before. Part of the reason for the losses, he felt, was the high interest rates and unavailability of mortgage money. Many brokers were dropping their association with the real estate boards. The average number of subscribers per board had dropped by almost 20%.

Even more important he felt that both the company's and his efforts were being diluted by the unrelated computer services that RDC was offering. He had not signed up one new board in almost 6 months. Annual computer expenses, including the programmer and two operators, were now over $50,000, and about $30,000 in computer service sales were being made. Their most profitable computer contract, a mailing list maintenance program for a rapidly-growing semiconductor company, was lost when the company purchased its own mini-computer.

Alden concluded that it was time to get out of the service bureau business and back to RDC's original business. A computer service bureau seemed like the best direction

[1]Alden had met Joe Skinner, a local auto dealer, at a professional sales organization meeting. Skinner had devised a customer follow-up program, and had convinced 4 other dealers to pay $300 each per month for the data processing. Alden invested over $5,000 in the programming in hopes of offering the service to other dealers as well.

to take because he might be able to sell the data processing contracts he had executed with many companies and auto dealers. After looking at many bureaus, Alden chose Datops, the same company which had punched out the 80,000 cards for RDC almost two years ago. Datops was a small five-year-old bureau doing computer work for several well-known local companies.

Datops promised one-day turnaround, and would re-write all of RDC's programs in COBOL, a higher-level language. Datops had quoted $4,000 to write the programs, but agreed to exchange them for RDC's assignment of their computer service customer contracts. Datops would use its Honeywell 2000 tape system to do RDC's work, and the hourly charge was $22.50. A monthly cost of $1,000-$1,200 was estimated. In addition, RDC had to lease two 80-column keypunch machines, and retrain its four keypunch operators.

RDC purchased a used Addressograph multilith press for $750 to offset-print the weekly computer reports. In the last two years, the cost of continuous-form paper had increased to almost triple the cost of plain white offset paper. Total printing costs on the offset press actually decreased from running multiple copies of reports on the computer (even considering computer time as "free").

In July, 1974, computer problems again plagued Alden. Datops' printer was quite erratic. The tops of the letters often did not register. Some of the printed listings were almost illegible. (One board cancelled their contract, apparently because of the decreased print quality.)

In addition, the one-day turnaround was usually not met. Many times, an inexperienced operator either ran the job incorrectly or neglected to use a new ribbon (making the copy unfit for offset printing).

Finally, on July 23, 1974 Datops entered Chapter XI of the Federal Bankruptcy Act. One of their rights under this Act was to cancel any contracts they had executed. They chose to break the contract with RDC, and increase the rate to $40.00 per hour, effective immediately.

Alden could not tolerate paying $2,000 or more a month for unsatisfactory service. Total computer costs were actually about $2,300, counting keypunch rental costs of $180, and card costs of $120 per month. A change would surely have to be made. One alternative would be another service bureau, but he doubted if he could find a service bureau which recognized RDC's need for immediate turnaround and high print quality.

CHOOSING A MINI-COMPUTER

Alden investigated several mini-computer systems that were not even available when he started the company four years ago. For under $1,600 a month, he could have an in-house system that would satisfy his weekly needs. Once every three months, RDC could rent some time on a large system to run the quarterly recapitulation from a tape produced by his "mini". Alden felt that using two computer systems would make the most efficient use of both systems--the mini-computer for small weekly processing, and a large system for quarterly and annual jobs requiring considerably larger storage than was available on most mini-computer systems. Even if the larger storage capacity were available on a mini-computer, he questioned whether it would be worth the extra cost, since RDC would only use the additional capacity four or five times a year.

He outlined several alternative systems (Exhibit 7), and compared his present monthly computer costs to his estimates for a new service bureau and a mini-computer system (Exhibit 8). The programming costs were considerably lower for Datapoint, MTK and Lockheed because RDC could use the RPG II programs it had already written for the IBM System 3.

All five companies offered a matrix printer for at least $8,000 less than its line printer. Alden did not feel that the quality of the matrix printer was sharp enough for offset printing (each character was made up of many single dots, as opposed to a line printer, which struck a character much like a typewriter). Datapoint also offered a slower printer, which had about the same print speed as a matrix printer, but quality equal to or greater than the more expensive line printer. The Datapoint printer also had both upper-case and lower-case letter capability.

Alden was especially interested in the MTK system. Its cost was considerably less because RDC could qualify as a dealer, and possibly sell systems to MLS boards as a sideline to its regular business. MTK had agreed to convert Alden's RPG II programs to the MTK system at no cost. While there were no MTK systems in use in the area (other than MTK's own system). Alden had confirmed that there were six satisfied users in the Philadelphia area. Furthermore, the Pantheon Company, with whom the service contract would be executed, had assured him that MTK's hardware was excellent, and almost service-free. Pan-

Exhibit 7

REALTRONICS DATA CORPORATION

Manufacturer	Print speed lines/min.	Hardware cost (ooo's)	Programming cost (000's)	Language	Capacity of 2 disks (000,000 bytes)*	# of other installations within 20 miles	Monthly lease payment**
BASIC 4	200	$48	$8	Basic only	5	40	$1,565
DATAPOINT	40	$43	$2	RPG II	5	12	1,230
M.T.K.	120	$35	--	RPG II	10	1	1,043
LOCKHEED	120	$43	$2	RPG II	5	0	1,317
SINGER	120	$51	$8	Table Processor, Assembly	8	5	1,680

*1,000,000 Bytes would be sufficient to hold 6250 records.

**Monthly payments included both hardware, programming costs and maintenance fees for a system consisting of a central processing unit (CPU), two cathode ray tube (CRT) terminals, two disks, and a printer. Except for Datapoint, which was a straight three-year lease, the monthly payment was a 66-month lease-purchase from a third-party lessor.

Exhibit 8

REALTRONICS DATA CORPORATION

Monthly Cost Comparisons (at 1974 Volume Level)

	Present service (Datops) bureau	New service bureau	Mini-computer estimate
Monthly time rental (50 hours)	$2,000	$1,600	--
Monthly lease--computer (including service)			$1,400 (max)
Lease payments if new programs are financed over 3 years	--	280	280 (max)
Travel (2 round trips/week)	80	100	--
Keypunch rental	180	180	--
Data processing cards	120	120	--
Electricity	--	--	100
Rental of outside time to run quarterly and annual recapitulation	--	--	120
Operator (1/2 time)			300
Total monthly cost	$2,380	$2,280	$2,200

theon maintained a complete parts inventory for MTK equipment, in Boston, and would guarantee service within 4 hours at any time. Alden had second thoughts about MTK, however, when the salesman failed to return several telephone calls, and their Boston office (and the only back-up system in the area) was closed for a two-week vacation without notice. Alden learned that MTK's parent company had gone bankrupt two years ago, and that MTK itself was not too financially strong.

Datapoint was the only mini-computer company Alden investigated that offered its own financing. The equipment could even be rented (with a one year minimum), although the monthly rental fee was about 30% higher than the monthly lease payment. While Datapoint's printer was slow, (a faster one was available for $6,000 extra) he could get all his work done if an operator worked all night long two nights each week.

One problem with Datapoint's RPG II language was that it was not possible to run two programs simultaneously (such as the Basic 4 and GRI systems could do). In order to take advantage of this "time-saving" feature RDC would have to pay about $8,000 to have its programs written in Databus, Datapoint's unique language.

Datapoint offered an "intelligent" terminal which could be used off-line to input data on cassette tape without tying up the computer. This terminal actually had 16K of core capacity (more core than the System 3 formerly used by RDC), and could be programmed to check data entered by the operator. For example, if an incorrect city code was punched, a buzzer would sound, and the operator could not continue entering data until the error was corrected. If certain fields were required to have data entered (e.g., the sale price of a property), the terminal would not allow the operator to skip over that field without entering a number. This "intelligent" terminal cost $225 per month compared to $90 for a "dumb" terminal which had to be connected to the computer. Edit checking was possible with all five mini-computers under consideration, but only Datapoint's could operate off-line.

Alden also liked the Basic 4 System's multi-programming feature. An operator could be keypunching data from one MLS board while the printer was creating reports for another board. In addition, up to 8 CRT's could be hooked up to the system at one time. On the other hand, he didn't like the idea of paying to have his programs written

in a fourth different language in less than five years.

All five companies quoted a 60-90 day delivery schedule, and seemed eager to help arrange RDC's programming requirements before installation. Alden was disappointed by the lower quality of the computer salesmen he had encountered with the mini-computer companies as opposed to his experience with IBM salesmen. The mini-computer salesmen never really seemed to understand his business requirements and did not express a convincing recommendation of the proper equipment to meet RDC's specific needs.

When it became apparent that Alden was going to make a decision very soon about a mini-computer system, the salesmen made some attractive offers as inducements for RDC's order. All but Lockheed offered free time on their computer system to convert RDC's voluminous card files to disk or tape. The Singer salesman offered cut-rate time on its large system to run the quarterly and annual recapitulation. Basic 4 made the most interesting offer of all --the salesman said that they were entering the final week of their fiscal year, and if the order could be placed within one week, he could offer the line printer for the same cost as the matrix printer, reducing the total cost from about $48,000 to $44,000. In addition, he had found a recently-unemployed programmer who could do the whole programming job for about $4,000 or about half of what they had originally quoted.

Since switching to the computer service bureau seven months ago, Alden had moved back into sales with great success. In spite of the bad real estate market, he had six new boards under contract (bringing his total to 14 boards), and he expected to sign up several more during the next few months. He expected 1974 sales to exceed $1,000,000, and a small profit to result.

One development concerned Alden, however. One MLS customer got its own mini-computer system (for less than $1,000 per month) and employed a local printer to produce its weekly listing book. The MLS board could completely pay for the mini-computer with what it saved on air freight charges from Providence each week. Alden wondered how many other boards might take this same route, and what implications this possibility might have on his choice of a data processing system. He wanted to make his next choice of a computer system to be the final one. More than anything, when he was out trying to sell an MLS board in Chicago, he did

not want to have to worry about whether data was being processed and delivered to a board in Miami.

QUESTIONS

1 Should Alden order a mini-computer? If so, which one?
2 How would you assess Alden's prior decisions concerning computer systems?
3 What are the critical elements in the choice of a computer system?

The Corporate HRS and Privacy: A Study at Cummins Engine Company

Leslie Levy

CUMMINS ENGINE COMPANY

When Joe Loughrey, Manager of Human Resource System at Cummins Engine Company, returned from lunch on July 1, 1976, he found the following note from Ted Marston, Vice President of Personnel:

> Joe,
>
> At a meeting yesterday with Frank over in the Engine Plant, some of his people were saying they prefer not to use the new Job Posting System to fill manager-level positions. They feel the reason is the time the Human Resource System takes to get them data on job applicants. Eighteen days pass before supervisors even know whom to interview. Sometimes it takes even longer.
>
> Furthermore, Frank's people say the Human Resource System isn't supplying the really important data about job applicants: things like people skills, attitudes, and work habits.
>
> Let's meet at four this afternoon to discuss how to handle this problem.
>
> Ted

Joe sat back in his chair and reflected. The Human Resource System (HRS) had been operational almost a year, and the most frequent complaint was that HRS was too slow. However, the problem wasn't due just to HRS. For example, actual information processing for the Job Posting System took only 3 days. (In fact, the HRS systems analyst had assured Joe that overnight turn-around was normal for reports.) The remaining 15 days resulted from 6 days for posting jobs worldwide at all Cummins plants and another 9 days for interested employees to respond. Joe estimated that no more than 5 of the 18 days could be

cut by improved procedures. Furthermore, when more than 18 days passed before managers could interview applicants, the delay occurred because managers were slow to give clearance to interview their people for new assignments.

Joe was particularly concerned with the opinion of some managers that HRS was really of interest only to Personnel. He was convinced that HRS would play an important role in determining the whole style of management at Cummins. That very day, at lunch, he had been discussing with his boss, Ron Hoge, Director of Personnel Administration, a proposal to begin planning for a personnel user systems group to coordinate the various automated systems that would eventually be needed to integrate Cummins' management of its organization.

Joe wondered what he could do to win over the managers who opposed HRS and what he should tell Ted Marston.

Background: Cummins Engine Company

Cummins Engine Company was described as the world's largest independent producer of diesel engines. Its major market was heavy-duty trucks. Almost half of U.S. heavy-duty trucks sold in 1975 were powered by Cummins diesel engines. Sales that year were $761.5 million, and earnings were $491,000. (Sales in 1976 were expected to reach $1 billion for the first time.)

Cummins prided itself as a leader, not only in sales, but in value and quality as well. Cummins engines were accepted the world over as a standard of excellence. The company's engine leadership resulted from an emphasis on research, which represented a powerful weapon against competition.

Cummins continuously expanded its international business, and more than 45% of the 1975 sales volume was generated abroad. The company had five plants in the United Kingdom and joint venture or licensee operations in Mexico, India, Japan, and Brazil. Cummins' international business produced both market and geographic diversification.

Cummins also expanded its productive capability through domestic plants in areas of the United States, including Charleston, South Carolina, and Jamestown, New York. In 1974, a new emphasis on industrial sales was initiated to provide greater market diversification. A plant was purchased in Seymour, Indiana to serve as the company's modification and shipment center for the industrial business.

In 1975, the recession helped cause a 5% drop in sales and a 98% drop in earnings. Cummins responded to the pressures of 1975 with an expense-cutting program. Some subsidiaries which were unprofitable or unrelated to the engine business were sold. Capital expenditures in 1975 were 50% of the previous year's. Debt was also sharply reduced.

Perhaps Cummins' most dramatic cost-cutting move was the layoff of about 1800 workers at its Columbus, Indiana, facilities, the largest layoff in the company's 56-year history. As a result of the layoff and attrition, staffing levels fell 12% from a work force of 20,364 at end-1974 to 17,971 at end-1975. Expenditures on salaries, wages, and benefits remained about 28% of sales, but employees per dollar of sales was at its lowest level in 10 years. However, the event was not without trauma for Cummins.

Some 50% of Cummins' work force worldwide was employed in the company's headquarters operations in Columbus, Indiana, a town of 27,000. One-third the total work force of Columbus was employed by Cummins Engine. Despite its rural flavor, however, Columbus is also an industrial town, with several firms besides Cummins located there. Employees tended to stay with Cummins or the other firms many years, often their entire working lives. The prosperity of Columbus and its number-one business depended on the ability to attract the necessary personnel to a rural community in the Midwest. "We would like to see it become the city in which the smartest, the ablest, the best young families anywhere would like to live..." said J. Irwin Miller, nephew of Cummins' founder, whose family owned 40% of the company's stock, and Chairman of the Board. Miller had led the rapid growth of the company since shortly after the close of World War II. Miller himself, raised in Columbus, had been convinced since childhood that it was an ideal locale. However, to convince others of Columbus' appeal, the company backed a variety of imaginative programs, including a system whereby Cummins Engine Foundation underwrote architects' fees for new public construction, provided architects of major stature were retained. Under this program, Columbus became an architectural mecca, featuring schools, libraries, churches, and even a firehouse designed by architects like Saarinen and Pei. The community, however, sometimes decided on other alternatives. "Our programs are offered, not pushed," Miller

observed. "The community should make its own decisions."

One result of the innovative design of Columbus' schools was that the city began to attract the highest quality teaching personnel. House and Garden in 1976 observed, "Ten years ago, it was hard to get new personnel to the small Midwest town to work. Today, there's no problem." Almost twice the national average of high school graduates from Columbus went on to college. Cummins attracted college graduates and M.B.A.s from leading colleges and universities around the United States.

The Cummins Engine Foundation oversaw the company's philanthropy program. Each year 5% of their U.S. before-tax profits were contributed to charity. Starting in 1975, the company intended to supplement domestic giving with up to 1% of international profits. Community involvement in Columbus was high. Active participation by Cummins personnel was encouraged. Executive leaves were sometimes granted for such work. In 1972, Cummins established the Corporate Action Division to supervise efforts to improve the role of minorities within Cummins; minority community development (both in Columbus, where Cummins supported fair housing; and in remote urban areas, where Cummins assisted community organizations); public service jobs, including training programs conducted by Cummins personnel; and the executive leave program. Cummins tried to select projects requiring competence available in the company. J. Irwin Miller explained Cummins' social program as the acts of a responsible citizen: "For its own freedom, for the maximum pursuit of its true property interests, the corporation, like the individual, must make a free response to the society of its time. Its response must be aimed at the good and the improvement of that society. It is, therefore, in our desire for a free society that we begin to find the reason for the social responsibility of a corporation."

One of Cummins' concerns was to assist government in developing legislation likely to affect the company. For example, when corporate disclosure became an issue in 1975, Cummins, according to the Annual Report, was among those few companies which responded to the SEC's"...request for our endorsement by making specific suggestions as to what types of information would seem to be most useful...." Cummins' management believed that legislation regulating corporate behavior generally results from abuses. To preserve freedom of action, Cummins believed, corporate conduct must be above suspicion. President Henry B.

Schacht stated, "We neither practice nor condone any activity that will not stand the most rigorous public ethical examination." The 1975 Annual Report added, "We continue to believe that, unless industry is willing to provide useful information and to bring to bear its own expertise and its own best estimate of the public interest, legislation formulated in a data vacuum will result in less effective and efficient approaches to regulation."

It is particularly important, claimed Ted Marston, Vice President of Personnel, to find a way of working with the regulatory agencies which administer legislation. To do this, companies should be open with agencies, tell them company problems, and solicit their help and advice.

While 1975 was a traumatic year for Cummins, corporate forecasts were positive. The 1975 Annual Report augured strong worldwide demand for trucks and heavy industrial equipment in coming years, following a slow recovery from the recession. The 1975 layoff had provided an opportunity for streamlining--now planning was necessary to meet future demand. Most planning revolved around organizational issues: for years, Cummins had been run as a centralized, functional company. Decisions were made in Columbus for all operations worldwide. Because of Cummins' growth, this style of decision making was becoming increasingly cumbersome. With scores of operations and offices located around the globe, and a forecast of increasing international expansion, decision making in Columbus was hampered by insufficient local data. Cummins needed to improve home-office decision making or else permit remote installations more autonomy. One recurrent problem was staffing. Most exempt staffing decisions were approved in Columbus. However, Personnel was of the opinion that suboptimal staffing resulted from inadequate data on Cummins' work force. Not enough cross-divisional transfers occurred, and political maneuvering played too large a role.

Initial Study of the Automated Personnel System

Cummins' Personnel organization had consisted for some time of a central staff, plus line personnel units with a dotted-line relationship to the Central Corporation Personnel Group. However, in mid-1974, Cummins' data processing organization was for the first time removed from Finance and became an independent corporate function within the Management Systems Division. Management Systems reported

directly to the Chief Operating Officer (Exhibit 1). Bill McMillan was hired as Director of System Development, reporting to the Vice President in charge of the Systems area of Management Systems. Around the same time, Systems Analyst John Rondot, who had been in Systems at Cummins almost 8 years, was assigned full time, at his own request, to work with Personnel on all data processing applications. As Bob Evans, then Manpower Planning Director, stated, "Suddenly we had our own guy in data processing, and he knew how to get what he wanted. Also, a key factor was that our guy had a lot of credibility in the Systems group." Consequently, when McMillan suggested developing an automated personnel system--an idea he brought with him to the company --someone within data processing stood ready to handle the job. By June 1974, McMillan had formed a preliminary team of himself, Rondot, and Evans to perform initial project analysis and evaluation.

The team first visited eight other companies of different sizes and types, all with automated personnel systems. Companies were selected more or less at random, though there was some tendency to concentrate on larger firms. A standard form was developed to report on findings. All team members went on every visit.

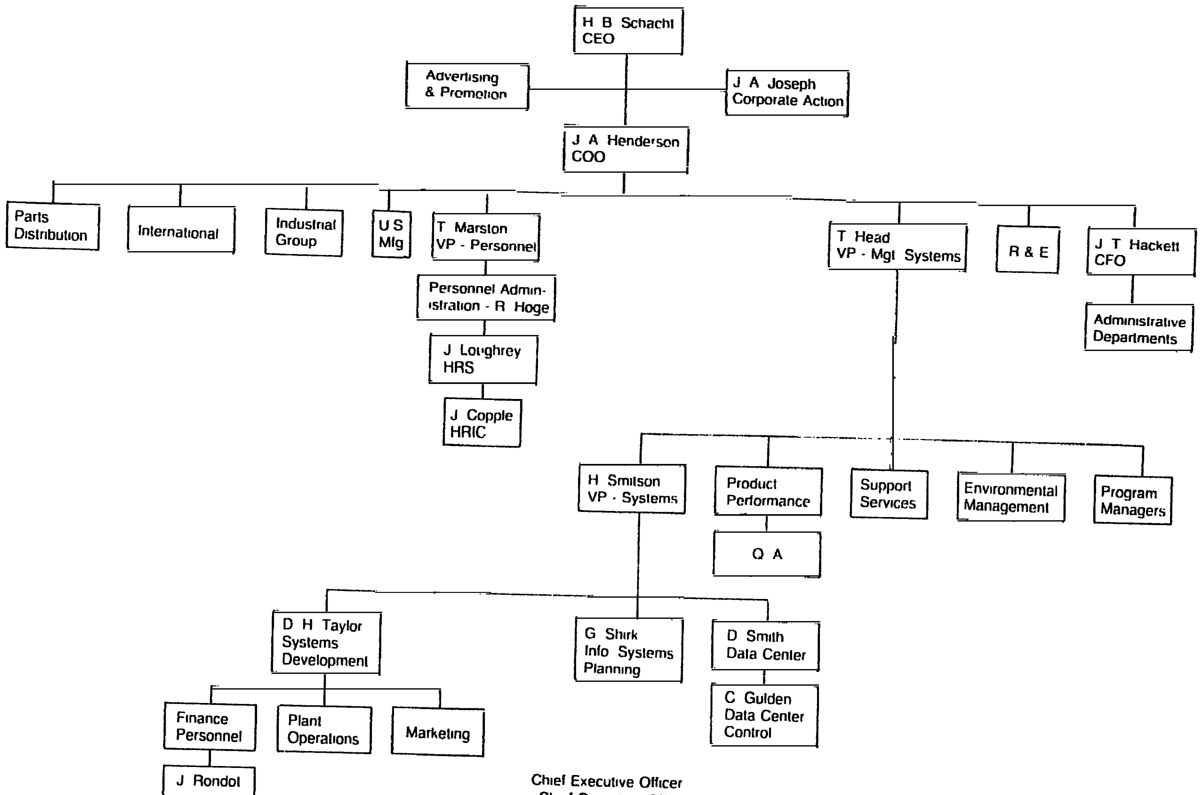
The team also began to audit Cummins' existing personnel systems, both manual and automated. There were three automated systems. A service-bureau-run skills inventory system provided career-planning and job-search data. However, some 300 Cummins employees did not enter data in the system. Many could see no advantage to themselves or the company in the system. Also, data in the system were known to be inaccurate because they hadn't been updated, though the system was expensive to operate.

By contrast, Cummins' in-house-developed payroll system was considered highly efficient and cost-effective. Organized by five-digit employee number, the system generated automatic deposits and other payroll-related data for each employee.

There was also a benefits/claims-processing system.

There was a central Personnel Records area where personnel folders were kept on people who were paid out of Columbus. Some managers maintained folders on each of their employees to supplement the voluminous folders kept by Personnel. Personnel folders frequently contained information dating back many years. Some managers said that informal files were often passed along when employees

Exhibit 1
CUMMINS ENGINE COMPANY
Organization Chart as of July 1976



Chief Executive Officer
Chief Operating Officer

were assigned to new managers, but sometimes previous managers retained copies. Although there were no procedures or documentation to regulate information maintenance, some managers kept similar data. There was no common processing. The lack of both discipline and economy in processing the wide variety of personal data at Cummins helped convince McMillan's team to pursue the idea of installing an automated personnel system.

To define the system best suited to Cummins, the team asked Cummins' managers for comments on present methods and suggestions for improvements. A major issue to surface as the team discussed its findings was privacy of personal data stored on computers.

The Privacy Issue--Background

In 1974, the U.S. Congress passed a Privacy Act, amending the Freedom of Information Act (FOIA) of 1966. FOIA provisions were extended to cover access rights in the important area of "personal" information held by the federal government. "The Privacy Act," according to the American Civil Liberties Union, "imposes upon the agencies of the Federal Government a 'code of fair information practices,' setting standards for the collection, maintenance, and dissemination of personal information which these agencies are legally bound to follow. It also places some limitations on the use of the Social Security number as a personal identifier. And it establishes a two-year Privacy Protection Study Commission whose task it is to develop recommendations for the further regulation, by legislation or otherwise, of private and governmental agencies." The Privacy Act, however, did not apply to state or local governments or to private organizations. The act set forth procedures for individuals (i.e., data subjects) who wished to find out what data about them was stored by the Federal Government and who wished to amend or append a protest to that data when they believed it was erroneous. Administrative and judicial appeals provided an ultimate means of resolving disputes between data subjects and federal agencies.

In January 1973, Representatives Koch and Goldwater introduced into the U.S. House of Representatives H.R. 1984, the Comprehensive Right to Privacy Act; it would extend federal privacy legislation to cover state and local governments and private organizations. The provisions of this act leaned sharply toward allowing individuals a strong

voice in determining the nature and extent of information stored about them and in controlling its maintenance, use, and dissemination. Administrative and public notice requirements were established. Rights of data subjects were defined, and constraints were established for use of a universal personal identifier. Criminal and civil penalties were prescribed. An important provision was the establishment of the Federal Privacy Board as a regulatory agency with broad powers of investigation and enforcement. Also, a philosophy was set forth governing the storage of personal information about individuals; the rights of organizations to store such data were to be limited, and numerous controls and procedures were to be instituted.

The provisions of H.R. 1984 extended far beyond any legislation previously introduced in this country at either federal or the state levels. In fact, although several states had enacted privacy statutes by 1976, only California had a law covering private business, and the California law was considerably less demanding than the proposed H.R. 1984. (In Europe, an EEC Privacy Commission was developing privacy guidelines which emphasized transfer of data across national boundaries.) Because the Comprehensive Right to Privacy Act represented so sizable a step beyond current practice, it was generally accepted that the bill would not be passed in its existing form. To determine potential effects of H.R. 1984 and gather suggestions for improved legislation on privacy, since a solid body of knowledge and experience did not yet exist, Goldwater and Koch mailed questionnaires to some 50 governors, 200 mayors, and 500 of the largest corporations. Respondents were asked to assess the potential impact of H.R. 1984 upon their organization: the estimate was to include dollar costs. In addition, suggestions and comments were solicited, along with descriptions of personal information currently stored and practices for handling it. Final survey results were not yet available in mid-1976.

One of the major issues in privacy legislation concerned compliance costs, which were largely unknown. First, because storage of personal data was so widespread and so decentralized, many organizations simply did not know what personal information "systems" they had. Second, because the assumption had been made that decision making could only improve with the application of additional data and that irrelevant data would simply cancel out of the decision-making process, the expansion of data banks was widely

regarded as desirable per se; thus, criteria to assess the advisability of storing an individual datum (or element of information) had been slow to develop. The availability of low-cost computerized storage had only reinforced this trend. Third, increasing use of computers for information storage had required concomitant technological development of security measures for new storage media. Because security measures had to apply to the latest computer designs, security technology had to develop at the same accelerated pace as computers themselves, but effects and costs of a changing technology are difficult to assess. Finally the issues surrounding privacy had themselves been unclear, a fact which seemed unlikely to deter the development of community sentiment or the passage of legislation. In 1973, Goldstein and Nolan wrote in the Harvard Business Review, "We can now safely predict that within the next year or two privacy will affect every organization that has computerized data about people, for either the federal government will act to impose uniform laws throughout the country or the states will take action on their own."

Despite wide areas of disagreement, those concerned with privacy were beginning to develop an intellectual framework for dealing with the problem. Thomas Watson of IBM said, "...The problem of privacy...is nothing more and nothing less than the root problem of the relation of each one of us to our fellow men." Goldstein and Nolan went somewhat further: The privacy issue "...is a direct effort to increase the power of individuals in their dealing with large organizations, which often seem remote, domineering, and unconcerned about individuals." However, the rights, not only of the public at large and of the data subject, had to be considered, but those of individuals who supply data, as well.

A tendency was growing to consider all regulatory issues in privacy as falling under three main headings:

1 Controls on data-processing and personnel procedures;
2 Access rights of data subjects;
3 Usage control by data subjects.

Some believed that the government should not attempt to regulate technology, but should set policy concerning use of data. They also thought the most important requirement in regulation was to assure that individuals participated in deciding how they would be affected by data stored.

One of the more sensitive questions was deciding who should pay the cost of developing and enforcing privacy legislation. Goldstein and Nolan presented a model for evaluating compliance costs for a number of systems having different characteristics. Using this model, the authors concluded that data base systems usually required the least outlay for compliance. No one claimed to know the cost of implementing privacy legislation; nevertheless, there seemed to be total agreement that privacy would prove very expensive. (Much of the required outlay would go into physical security measures, such as controlled-access data centers. However, programmed routines for identity checking for terminal users and audit trails could cost even more.) Cost estimates ranged from zero into the millions of dollars for individual companies. It was widely believed that the cost of privacy might deter the development of personal data systems.

Cummins and Privacy

In mid-1974, when Cummins began its initial study of automated personnel systems, privacy was not an issue at the company. At Cummins, virtually all personal information was available for the asking. Personal data was often left lying on desk tops. Salaries were routinely discussed and were considered common knowledge. In so small a town, it was impossible to keep secrets. Most employees, both exempt and nonexempt, expected to spend their entire lives as neighbors. In the words of one manager, privacy was in fact a "nonissue, since most Cummins employees could not separate their social and professional relationships and would routinely supply information, to which they have access in their jobs, to meet a friend's unexplained request." Moreover, no complaints about privacy were ever received to indicate that anyone objected to the widespread availability of personal data.

Nonetheless, according to Marston, within the last 5 years, the company had become concerned with access of personal data. There had been numerous abuses, despite the absence of complaints. For example, one manager recalled that a senior manager had requested a list of his unmarried employees so that he could canvass them for contributions to a political cause. (The attempt failed.) In addition, privacy was becoming an issue of national concern. In April 1975, Henry Schacht was appointed to the Privacy Com-

mission of the State of Indiana. By that time, restrictions had been gradually imposed at Cummins. Cummins no longer publicized employee births, length of service, etc., without employee consent. Various kinds of personal data were eliminated from Personnel files. Although a high-ranking Personnel manager could still claim in mid-1976 that no key privacy issues faced Cummins, the climate of opinion had begun to change. According to Marston, privacy was a major personnel issue.

Thus, there had been some basis in 1974 for Personnel to emphasize both privacy and security in developing specifications for an automated personnel system. (Privacy considerations deal with what data may properly be stored, used, and disseminated. Security provisions safeguard data from misuse. Whether data can be securely stored obviously affects whether an organization is entitled to store it.) In fact, privacy had a definite place in Cummins' initial system study. The following steps were taken by the team to determine what data ought to be stored and reported:

1 All file systems, manual and computerized, containing personal information about employees were identified;
2 Each data element in each file was listed;
3 The purpose and appropriateness of each data element was evaluated;
4 Accessiblity and use of data were determined;
5 Periodic reports generated from the file were reviewed;
6 Possible short- or long-term integration with the proposed automated personnel system was outlined;
7 Initial decisions about each file were made to meet evolving privacy policy.

Project Approval

After 3 months, the team had presented preliminary findings at a General Design Review, on November 5, 1974. System development was recommended to meet the following objectives:

1 Create and maintain data for personnel actions;
2 Provide capability for timely access to personnel data files;
3 Provide capability for data analysis reporting;
4 Provide for on-line inquiry and update of personnel files;

5 Create and maintain data for government reporting;

6 Provide capability for expansion to all employee worldwide systems;

7 Provide coordination between personnel system and existing payroll/benefit systems;

8 Address Personnel's future needs.

Significant paper economies were anticipated. However, most important--though not explicitly stated--was the need to enter into the data base the information necessary to enable Cummins' management to continue making and implementing major personnel decisions out of Columbus. "Most decisions were still based on 10,000 people in Columbus," said one manager. It had become hard to get adequate, up-to-date data to plan succession and to fill vacancies. The automated personnel system would help Cummins' management to continue to operate in what President Schacht called a "humane, informal way."

In selecting a method to reach their objectives, the team investigated five alternatives:

1 Purchase of a package personnel system;

2 Purchase of a package timesharing personnel system;

3 Purchase of a package personnel system with in-house written data-base system, including on-line inquiry capability and IBM's information Management System (IMS) dump;

4 Design and implementation of an in-house-written data-base personnel system, based on IMS, with batch update and on-line inquiry capabilities;

5 Design and implementation of an in-house-written IMS personnel system with on-line update and on-line inquiry capabilities.

Each alternative was evaluated in terms of adequacy of data and system security; implementation time; growth/enhancement capability; start-up and operating costs; requirements to interface with other systems; expertise required within Cummins Personnel; manpower requirements; and ability to meet the objectives listed previously. According to John Rondot, however, many decisions were actually made by "gut feel."

An early decision was made to drop consideration of a timesharing system, due to Cummins' unfavorable experience with the skills inventory system. According to Rondot, Evans knew the skills inventory system and didn't even want

to hear about timesharing; he didn't feel that an off-site timesharing system was the answer to Cummins' problems. Rondot himself was uncomfortable with the fact that both the system and the files would have been located in Cleveland. "From the standpoint of a data processing person," he argued, "if I can't get my hands on the system, it bothers me." In addition, remote files seemed a security risk. Although start-up time was fastest under timesharing, subsequent processing enhancements would require programming. Although initial outlay would be low, operating expenses were the highest of any alternative. Interface to existing programs would require duplicate transactions or special interface programs. A high degree of expertise would be required in Personnel, since the timesharing people could not be expected to know much about a particular application. On the other hand, the staffing requirements in data processing would be low. All major objectives would be met, but the team decided the negatives could not be overlooked.

Alternatives 3, 4, and 5 were evaluated and rejected together. Any desired level of security and growth/enhancement capability could be incorporated in an in-house system. Start-up costs were almost exclusively in salaries and teleprocessing hook-up charges; however, operating costs would exceed those of a package system. In-house systems would be tailored to Cummins' interface requirements, and all system objectives could be met. However, an in-house system would take longest to implement. One important reason was that expertise in automated systems would have to be acquired in Personnel. While Rondot, who prepared the evaluation, did not consider Personnel's staffing requirements, he did note the heavy manpower budget for data processing to develop an in-house system. Since the proposal came during a hiring freeze, it was impossible to hire programmers. According to one Personnel manager, "We prefer to train than to hire. That is an extreme strength of the company, but it does tend to make projects last longer." In addition, the team ruled out any system involving sizable technological risk in Data Processing and Personnel because changeover to an automated system would tax Personnel enough to warrant conservatism elsewhere. Accordingly, although Cummins was a leader in use of IMS, the team decided against an interactive, on-line system.

Thus, the decision evolved to purchase a system. Cummins' limited recent experience with purchased systems had been good. Further, going outside would settle the nagging prob-

lem of simultaneous development of personnel systems in different divisions within Cummins. Security could be assured by a central preparation area with exclusive right to interface with the system. Also, a package would include protective software. The initial system would be in operation within 6 months. Add-on modules would provide for future growth and enhancements. While front-end purchase costs would be highest under this alternative, operating costs would be low. Interface to other Cummins systems would demand program modifications, but these would not destroy overall cost-effectiveness. One particularly important feature with a package system was that Cummins could tap the expertise of the supplier. This meant the supplier would train personnel and that staffing requirements in data processing could be minimized. While an on-line interactive system could be purchased outside, the team recommended a batch system because vendors had not yet completed development of personnel systems using the more advanced technology. "I think we had a tendency not to want to be a guinea pig," said Rondot. "Besides, I felt a batch mode was more appropriate for where we were."

Rondot next prepared a chart comparing the three vendors of automated personnel systems (Exhibit 2). A number of criteria were used, including some of the original ones on which the decision to purchase an outside system had been based. However, the team added criteria as its understanding of automated personnel systems grew. At the feasibility review on November 26, Rondot compared the three package suppliers which the team had evaluated (Exhibit 3). The team recommended that Cummins buy the Human Resource System (HRS) sold by Information Science Incorporated (InSci). For this system, Cummins would pay InSci $44,500, plus $7,500 for a special programmed interface to Cummins' existing payroll system. Also, Cummins would pay reasonable out-of-pocket expenses of InSci personnel.

Information Science Incorporated

InSci was founded in 1965, under the leadership of Dale H. Learn, with the objective of developing, marketing, installing, and servicing automated personnel systems. The founders of InSci combined a broad range of experience in both data processing and personnel, as well as heavy consulting background. Dale Learn had worked on automated personnel systems at IBM, before founding InSci.

Exhibit 2

CUMMINS ENGINE COMPANY

John Rondot's Chart to Evaluate Vendors of Automated Personnel Systems

Form 3572 REV. 7/70

Title: Firm/System Rating Grid (CPS) Author: Rondot Date: 10/11/74 Page 1 of 3

Horizontal Detailed System General Program Detailed ,ram D. P. Operations

Element	Alternative Vendor I and System	HRS--II Information Science Incorporated	Alternative Vendor and System II
System Installation Time	4--6 Months After Approval	6 Months After Approval	6 Months After Approval
Turn Around Document Concept	Uses Concept--Extensive Benefits Profile--Career Profile in Skills Moldule	Uses Concept--Employee & Career Profiles	Uses Concept--Employee, Career, & Skills Profile
Generalized Report Retrieval System	9 Searches Per Run	Uses GRS--General Retrieval System--Written by InSci--99 Searches	Uses Own Retrieval System 99 Searches/Run
Human Resource Center Concept	Uses Concept	Uses Concept--Calls It Human Resource Information Center (HRIC)	Uses Concept
Government Reports	Chronological Work History--EEO--Thru Retrieval System	Perpetual Employment History--EEO--Thru General Retireval System	Chronological Work History--EEO--Thru Own Retrieval System

Exhibit 2

CUMMINS ENGINE COMPANY

John Rondot's Chart to Evaluate Vendors of Automated Personnel Systems (Continued)

Horizontal Detailed System General Program Detailed Program D. P. Operations

Element	Alternative Vendor I and System	HRS--II Information Science Incorporated	Alternative Vendor and System II
Man Days Provided On Site	5 Days--$250.00/Day & Expenses For Over 5 Days	12 Days	Not Specified--Whatever Is Needed to Familiarize Cummins With System
Warranty Period On System	1 Year	2 Years	2 Years
Systems Operational Or In Process	4--7--Includes Some Major Corporations	Approaching 200--List of Clients Available	3--4--Includes 2 Major Corporations
Flexibility On System Changes	Extremely Flexible--Maybe Too Flexible To Fit In Set Time Frame	Fairly Rigid--More Costly Than Others --Like To Use Package As Is	Fairly Flexible--Cost Is In The Middle--Should Be Easy To Work With
Data Base Design	Flexible--Sequential Tape Or Disk--Approx. Up to 4,000 Characters/Person	Flexible--Sequential Tape Or Disk--219 Data Elements For Selection	Flexible--Sequential Tape Or Disk--219 Data Elements For Selection
Payroll System Interface	Will Modify System At Proposed Cost of $3,500.00	Will Modify System At Proposed Cost of $6,000--$9,000	Will Modify System At Proposed Cost of $5,000--$7,000
Cost On System Modifications	Cost Basis & Out of Pocket Expenses	Cost Basis & Out Of Pocket Expenses	Cost Basis & Out Of Pocket Expenses

Package Cost (Approximately	$64,500.000	$65,500.000	$70,000.00
Terms Of Cost--Free Problem Correction	1 Year	6 Months	Not Specified
Training Provided	Sufficient To Insure A Successful Transfer To Cummins	Training Of All Personnel & DP In Use Of System Specific Courses Planned	Assist Cummins In Training In Functions & Operation Of System
Approach To Implementation	Significant Meetings --Work Done In Their Offices--Fairly Systematic	Extremely Systematic --Use Project Management Approach	Very General Implementation Plan --Tailored To Each Company's Needs
Documentation	User Manual-- Procedures Manual-- Operating Procedures Manual	User Manual--Managers Manual--Program Documentation	User Manual--Operations Documentation--System Reference Manual
After Installation Support	Analysts On Call-- Their Time--Systems Assurance Agreement	Systems Assurance Dept. On Call--New Jersey Time--Systems Assurance Agreement	Will Work On Quickest Way To Fix Problems-- Available As Required
Growth Possibilities To Additional Systems	Personalized Annual Report--Attendance Reporting	Health & Safety Module--Personalized Annual Report Attendance	Personalized Annual Report--

Exhibit 2

CUMMINS ENGINE COMPANY

John Rondot's Chart to Evaluate Vendors of Automated Personnel Systems (Continued)

Horizontal Detailed System General Program Detailed Program D. P. Operations

Element	Alternative Vendor I and System	HRS--II Information Science Incorporated	Alternative Vendor and System II
Consulting Ability On General Personnel Matters	Strong On Benefits Area	User's Conference Annually Bi-monthly Publication To Assist Users	Consulting Firm--Strong In All Areas Of Personnel & Compensation
Strongest Aspects Of Company/System	Strength in Benefits Areas--Low Cost--Cut Price To Get Business	Proven Software Package In Business Since 1965	Strength In Consulting --Old Established Firm --Help In Use Of System
Detriments To Company/System	Cummins Would Help Pioneer This System--Not Enough On-Site Time	High Costs on System Modifications	Cummins Would Help Pioneer This System--Pl Not Firm Enough

Exhibit 3
CUMMINS ENGINE COMPANY
Supplier Selection Package Suppliers,
Comparison of Vendors of Automated Personnel Systems,
Feasibility Review

Alternative Supplier I, a division of another company, has been in the package personnel system business for about 3 years. Has extensive experience in benefits statements, personalized annual reports, etc. Has less than 10 packaged personnel systems installed.

Information Science Inc. (InSci), a subsidiary of CPC, International, has been in the package personnel system business since 1965. They had installed approximately 200 personnel systems. InSci has developed other modules which can be installed to interface with the personnel system. InSci uses a rigid project management system to implement the project on schedule.

Alternative Supplier II is a consulting firm founded in 1917. Has offices in the U.S., Canada, and Europe. It is relatively new in the area of packaged personnel systems with only about 5 installed. Their strength would be in the consulting aspect as to how the system could be used.

Supplier/Package Selection

- Major differences between packages:
  InSci has perpetual employment history to satisfy EEO questions. Others not nearly as extensive in this area.
  Supplier days on site--varies from 5 days (Alternative 1) to 12 days (InSci) to whatever is necessary for smooth implementation (Alternative II).
  Warranty periods--Alternative II and InSci are warranted for 2 years--Alternative I, 1 year.
  Current systems in operation--InSci has approximately 200 systems in operation; others have less than 10 each.
  Flexibility on change--Alternative I extremely flexible, Alternative II fairly flexible, InSci extremely rigid (like to use package as is).
  Training--InSci has considerable training of operating people included in its plan. Alternative II will assist Cummins in training the operating people--Alternative I will train Cummins people whatever is sufficient to insure a successful implementation.

Exhibit 3
CUMMINS ENGINE COMPANY
Supplier Selection Package Suppliers,
Comparison of Vendors of Automated Personnel Systems,
Feasibility Review (Continued)

Included in system
- Payroll modification to minimize change to our payroll system.
- Career profile documents showing employees work and education history.
- Employee profile documents showing data on employee.

Support supplied by InSci
- Assitance in training in the personnel area and in the data processing area.
- Assistance in developing forms, report layouts, and user's manuals.
- Assistance in making better use of the system thru flexible, comprehensive data base design.
- Expertise in personnel systems area.
- Full project management and direction during implementation.
- Provide instructions against a rigid schedule.

InSci was probably the first of the small companies dedicated to automated personnel systems and was generally conceded to have done most of the pioneering in the field. According to John Rondot, virtually all the competition's people came from InSci, and all three companies investigated by Cummins sold essentially the same system.

The important difference, in Rondot's opinion, was InSci's greater experience, which made the company more valuable to Cummins, since Cummins was determined to avoid pioneering. The weight of InSci's experience was reinforced by its determination to concentrate resources in deepening its areas of strength. Thus, InSci preferred to use standardized software where possible; customization was avoided in this high-risk, high-expense area. InSci tried to use the same rigid project-management methods at every installation. This approach would restrict Cummins' need for in-house expertise to monitor progress and quality. Reliance on established methods limited problems and thus freed InSci's resources for the study and innovation which permitted the company to maintain state-of-the-art technology in its products. InSci thus assumed much of the risk of pioneering for its client companies, while they received the benefits.

To reinforce its reputation for reliability, upon which clients' perception of reduced risk depended, InSci worked closely with each customer to assure successful, operational systems. InSci either installed each system or operated it for the customer. Follow-up support assured continuing satisfaction. Maintenance, instruction, guidelines, magazines, and seminars were provided for customers. InSci also worked with potential customers to obtain management approval for projects.

The Contract between InSci and Cummins

Following the feasibility review, a Request for Appropriation (RFA) was approved by Cummins' management in December 1974. Dollar impact was not evaluated in detail. According to one Personnel manager, "Cost wasn't a major factor because it wasn't prohibitive--it was something we were going to do anyway." The RFA was written to agree with amounts already approved in the 1975 budget.

The contract between InSci and Cummins was signed on January 21, 1975. The original system would be installed for Cummins' 2,400 exempt employees at Columbus and would be operational by July 11, 1975. Later, after thorough

debug, other domestic and international plants would be added. (This decision meant that employees who worked in other states, but whose records were at Columbus, would be among the first entries--e.g., the San Francisco sales office.) The contract itself did not contain explicit provisions for what would constitute satisfactory action on the part of the two parties. Because little legal precedent existed for software purchases, both Cummins and InSci would rely heavily on one another's good faith for successful contract completion.

To satisfy the terms of the contract, Joe Loughrey was appointed project coordinator at Cummins. Previously manager of employment, Loughrey had come to Cummins from serving 2 years as president of AIESEC, a student organization based in New York City. Loughrey had joined the team evaluating the automated personnel system in January 1975. During that time, he and John Rondot had built a relationship of mutual trust and respect. Both men felt that this relationship would be essential to the project's success, especially since Personnel requests had always been low-priority items in Data Processing. When the system was up and running, Loughrey would assume operational responsiblity for it within Personnel.

Project Implementation

Implementation was conducted under InSci's leadership. At the kickoff meeting, before the contract had actually been signed, InSci explained its role and that of Cummins. InSci would act as project manager and teach Cummins personnel how to use the new system. Cummins' most important tasks would be deciding what data to store; what input and output forms to use; and what procedures to establish for running the system. InSci would assist Cummins in all these tasks as required. Project activity would be coordinated by use of a GANTT chart composed by InSci. All parties would be expected to meet prescribed deadlines. The system proceeded according to schedule and was tested by InSci at its New Jersey installation. The first live data load occurred at Columbus on July 1, 1975. Two updates were required before the system was fully operational. No "glitch" of any magnitude occurred during implementation. In 1976, Cummins' personnel were of the opinion that only minor problems had arisen after installaton. "We're sure we made the right choice," said Rondot.

Between January and July 1975, Cummins' management developed corporate policies to handle a number of issues raised during installation of the new Human Resource System (HRS). As Joe Loughrey thought about the role of HRS at Cummins, he took the opportunity to reflect once again on some of those issues and consider their implications for this role.

Effect of HRS on Labor Relations

The longest work stoppage in Cummins' history had occurred when the Diesel Workers struck the Columbus plant for 57 days in 1972. (Except for the office workers' union, this was the only union at Cummins in Columbus.) After 1972, according to one Cummins manager, the union became more aware of its strength and grew careful about new equipment introduced into any Cummins plant. Nonetheless, high wage rates continued to assure worker availability, while Cummins' acceptance of the union had prevented serious disputes. During one hiring campaign, response was so great that telephone service throughout southern Indiana was disrupted.

During the summer of 1974, Cummins discussed its proposed automated personnel system with the union, and Joe Loughrey expected to consult the union again when hourly workers were entered on the system. Because terms and conditions of work were defined by negotiation and contract for hourly employees, Cummins anticipated that any issues concerning HRS would be settled by collective bargaining. The company expected that hourly employees would cooperate in data entry. No major problems were foreseen.

EEO and HRS

Cummins expected to use HRS to generate required statistics for affirmative action reporting. Previously, reports had been the responsibility of an Equal Employment Opportunity group with no formal link to HRS. A table from the 1975 Annual Report produced by this group (Exhibit 4) seemed to imply that Cummins was increasing minority and female representation only among less trained, declining categories; however, Joe Loughrey knew that the statistics were misleading because they relied upon a new system under which jobs were reclassified in different ways and at different times. All subsequent EEO reports would come out of HRS. Thus, Cummins hoped to alleviate the concern among some

Exhibit 4

CUMMINS ENGINE COMPANY

Equal Employment Opportunity Data for Cummins Engine, as Presented in the 1975 Annual Report, Consolidated Figures for Cummins Engine Company, Inc., and U.S. Subsidiaries for 1972-1975

		All Employees			Minority Group Employees		
Categories*	Year	Total	Male	Female	Total	Male	Female
Officials	1972	868	858	10	17	17	0
	1973	1478	1453	25	45	45	0
	1974	1763	1708	55	64	60	4
	1975	1479	1437	42	61	58	3
Professionals and Sales Workers	1972	1492	1447	45	63	56	7
	1973	1059	1001	58	64	52	12
	1974	1014	926	88	69	56	13
	1975	1383	1282	101	94	72	22
Technicians	1972	587	572	15	18	16	2
	1973	631	600	31	18	15	3
	1974	669	638	31	19	17	2
	1975	307	262	45	6	6	0
Office & Clerical	1972	1293	448	845	45	5	40
	1973	1312	401	911	62	7	55
	1974	1399	417	982	75	10	65
	1975	1336	401	935	71	9	62
Craftsmen (Skilled)	1972	2233	2224	9	65	63	2
	1973	2413	2395	18	84	80	4
	1974	2556	2505	51	87	75	12
	1975	1178	1069	109	157	119	38

Operatives (Semi-skilled)	1972	4233	4010	223	273	176	97
	1973	4483	4090	393	307	187	120
	1974	4584	4102	482	311	197	114
	1975	5592	5202	390	190	121	69
Laborers (Unskilled)	1972	933	677	256	155	97	58
	1973	1028	772	256	103	58	50
	1974	1044	764	280	88	68	20
	1975	1051	841	210	63	47	16
Service Workers	1972	130	125	5	6	6	0
	1973	157	143	14	9	9	0
	1974	191	167	24	7	7	0
	1975	185	167	18	8	7	1
Total	1972	11769	10361	1408	642	436	206
	1973	12561	10855	1706	697	453	244
	1974	13220	11227	1993	720	490	230
	1975	12511	10661	1850	650	439	211

*Data compiled from EEO-1 Reports submitted annually to the U.S. Government based on employee statistics as of March 31 for each year listed.

market analysts caused by publication of the 1975 figures. In addition, HRS would allow Cummins to respond rapidly to intermittent governmental requests for statistical analyses of the work force and could be helpful in the event of discrimination suits brought against the company.

Within Cummins' affirmative action program, representation of women and representation of minorities in the work force were handled separately. Ted Marston explained that there was little data on professional women, as the company had made a serious effort to achieve balance in this area only since 1973. Cummins' goal for salaried women was to reflect "...women in proportion to their availability and requisite skills."

One problem in getting better distribution of females in the shop hourly work force involved the waiver system. Hourly women refused promotions in favor of jobs which were less physically demanding. Marston would have liked to request help from EEOC before the waiver system produced clear inequity.

In general, Cummins had difficulty attracting women in sufficient numbers. The problem became even more acute at layoff time when women and minorities left the hourly work force in disproportionate numbers because of seniority provisions. Cummins provided help to the salaried work force in relocation and finding reemployment to alleviate the problem. A counseling center was provided for hourly employees. The company's goal for the hourly work force was to "equal the available percentage of minority and female persons in the recruiting areas of the Company's facilities."

Cummins' program for minorities was of longer duration than that for women. The company had made a determined effort to attract educated minorities, and there was a heavy influx of immigrant minorities into Columbus starting around 1968. Cummins' goal for salaried minorities was to reflect the proportion in the national work force. One black executive estimated that 99% of the minorities in Columbus were professionals hired by Cummins, though those in manufacturing still tended to be hourly workers. A survey in 1974 by an internal Cummins team revealed a startling absence of historical data on employees, which made it difficult to reconstruct individual salary and work history for use in comparing the ways different groups were treated. Although the same black manager estimated little change since 1973, maintaining data on the HRS could alleviate

the situation. The HRS could also be useful for keeping applicant records required by EEOC (as well as providing a storage medium for information about retirees).

One problem was to resolve the EEO requirements for data retention with a policy of storing only necessary data as a safeguard of individual employee privacy. Legal guidance was required, but Loughrey expected that Cummins would probably retain only summary applicant data long term; person-identifiable applicant information would be purged at the end of each year. However, person-identifiable data on employees would be kept for longer periods.

Entering Data on HRS

In order to encourage employees to enter and maintain personal data on HRS, they were assigned full responsibility for data entry and were told how data would be used. The employees' HRS manual explained that, unless employees provided timely data, supervisors would lack information to evaluate them for job openings. Cummins adapted InSci's Employee Profile (Exhibit 5) for use as a simple, turnaround document for both data input and output. Full instructions appeared on the Profile itself, which also contained the following message to employees:

> We feel it is your responsibility to inform us when we should correct, erase, or amend inaccurate, obsolete, or irrelevant information.

New hires provided initial HRS input on the first working day, with guidance from employment representatives. The employee received his first printed Profile at about the time of his first paycheck. Reminders were then issued every 3 months to encourage employees to keep their records updated. Employees were instructed to bring questions and problems to their line personnel representatives. According to Evans, most employees wanted to fill out their forms. "It's an ego trip--it's fun to tell other people about ourselves," he said.

When Cummins first introduced HRS, it was explained in the company magazine, as well as in numerous memos from management. Nonetheless, employees who had experienced difficulty with previous systems were sometimes reluctant to enter personal information into the specially prepared Data Collection booklets. According to John Rondot, "What we

Exhibit 5
CUMMINS ENGINE COMPANY
Employee Profile

GENERAL INSTRUCTIONS

The information shown on the reverse side of this form is a major part of your Cummins personnel record The Human Resource Information Center (HRIC) and your line personnel unit also have a copy of this profile A copy will also be provided for review to the supervisor of any job for which you are being considered. However, your Social Security number, race, sex, marital status, date of birth, country of citizenship, number of dependents, children's ages and sex, and beneficiary's name appear only on your copy and the HRIC copy

We need to keep the information on your Profile accurate and current We feel that it is your responsibility to inform us when we should correct, erase, or amend inaccurate, obsolete, or irrelevant information The instructions for doing this are below We ask you to take particular responsibility for the accuracy of personal information, benefits information, formal education, education and training courses and military history Any time there is a major change in any information on this Profile a new Profile will be generated and a copy will be forwarded to you and to your line personnel unit

The Human Resource Information Center is responsible for protecting the privacy of this information and for insuring that any information about you is released only on a right-to-know basis or with your written consent At the present time (February 1976), no additional information to that printed on the reverse side is stored in the Human Resource System However, it is anticipated that within the next year, we will begin to store but not print such information as budgeted salary increase and bonus and stock options. If you have any questions about the purpose for which information has been collected about you, particulars about its use and dissemination or about the Human Resource System itself, please do not hesitate to contact your line personnel unit or the Human Resource Information Center.

Some additional information will continue to be stored in your personnel file folder At your request, you may review this information by contacting your line personnel organization They will assist you in making any necessary corrections to your personnel records

EMPLOYEE PROFILE AND AUTHORIZATION

Date Change Made

H R I C —HUMAN RESOURCE INFORMATION CENTER

PLEASE PRINT ALL ENTRIES CLEARLY

Month Day Year (enter on top of reverse side)

When an instruction requires entering a code, please enter the appropriate code exactly as shown Information normally recorded with spaces or punctuation between numbers, such as social security number or a date, should be entered as consecutive digits without inserting dashes or slashes. When making an entry, always

1 Show the number 'zero' in this manner 0
2 Show the letter 'O' in this manner Ø
3 Show the number 'one' in this manner 1
4 Show the letter 'I' in this manner I
5 Show the number 'two' in this manner 2
6 Show the Letter 'Z' in this Manner Ƶ

☐ **CHANGE IN CONTROL INFORMATION route to H.R.I.C. through appropriate levels of supervision for approval.**

- ☐ Leave of Absence—enter expected return date from leave on line 1 (Block 001) Reason Check one) ☐ illness ☐ education ☐ maternity ☐ military ☐ personal ☐ other
- ☐ Return from Leave—forward employee profile to H R I C Indicate date of return under comments
- ☐ Location Transfer—enter new location code and date on line 11 (Block 025) Explain under comments
- ☐ Termination—forward Employee Profile to H R I C Indicate reason for termination under comments
- ☐ Other Changes—cross out old data and enter new information If necessary, refer to Manager's Manual for instructions

☐ **CHANGE IN SALARY INFORMATION route to H.R.I.C. through appropriate levels of supervision for approval.**

Enter type, amount of change, eff date and period/freq on line 5 (Block 032) Use appropriate type change codes. Refer to Manager's Manual for instructions

☐ **CHANGE IN PERFORMANCE REVIEW—attach complete appraisal. Route to H.R.I.C.**

Enter type, date and rating on line 5 (Block 026) Use appropriate type and rating codes Refer to Manager's Manual for instructions

☐ **CHANGE IN PERSONAL INFORMATION—cross out old data on reverse side, enter new. Route to H.R.I.C.**

- ☐ Name—change on line 10 (Block 002)
- ☐ Marital Status—change or enter on line 10 (Block 010) Use appropriate code S - Single, M = Married; E Married to Cummins Employee
- ☐ Address/Telephone—change entire address on line 12, (Blocks 003, 004, 005) If telephone number has changed, enter on line 12 (Block 006)
- ☐ Other Changes—cross out old data, and enter new information If necessary, refer to Manager's Manual for instructions.

Exhibit 5
CUMMINS ENGINE COMPANY
Employee Profile (Continued)

[ ] **CHANGE IN BENEFITS INFORMATION—cross out old data on reverse side, enter new. Route to H.R.I.C.**

[ ] Beneficiary—change entire beneficiary designation on line 16 (Block 040).
[ ] Benefits Participation—change participation code and effective date on line 14-16 Use Appropriate participation/plan codes

[ ] **CHANGE IN OTHER INFORMATION—cross out old data on reverse side, enter new. Route to H.R.I.C.**

[ ] **CHANGE IN FORMAL EDUCATION—cross out old data on reverse side, enter new below. Refer to Manager's Manual.**

	Level Code	Level Name	Yr Att	Subject Code	Subject Name	School Code	School Name	
020								Highest Level
021								Addt'l Level 1
022								Addt'l Level 2

	Credits Obtained	Credits Needed
023		

[ ] **CHANGE IN EDUCATION AND TRAINING COURSES—cross out old data on reverse side, enter new below. Refer to Manager's Manual.**

Course Code	Date	Description/Location	Duration	Grade	TYPE	2	3

[ ] **CHANGE IN PRIOR EMPLOYMENT/MILITARY HISTORY—cross out old data on reverse side, enter new below. Refer to Manager's Manual.**

Company Name	From	To	Job Title/Duties

COMMENTS/APPROVALS

Approved by Date	Approved by Date	Approved by Date
Approved by Date	Approved by Date	Approved by Date

Exhibit 5

CUMMINS ENGINE COMPANY

Employee Profile (Continued)

PROFILE DATE	EMPLOYEE NAME	LOCATION CODE	[redacted]	PAGE	01	EMPLOYEE NUMBER	DATE CHANGE MADE

CONTROL INFORMATION

1	TRANS CODE	TRANSACTION NAME	LOA RETURN DATE	CAT CODE	SENIORITY DATE MO DA YR	ORIGINAL HIRE DATE MO DA YR	REHIRE DATE MO DA YR	WOULD REHIRE	IN PLANT PHONE	UNION	
2	JOB CODE	DATE ????	JOB TITLE	FLSA	EEO	EVAL PTB	EVAL	EVAL DATE	SUPV	CLASS RANGE	PHY CODE / SHIFT
3	SALARY GRADE	RANGE MINIMUM	RANGE MIDPOINT	RANGE MAXIMUM	% RANGE	COMPA RATIO	WEEKLY EQUIV	MONTHLY EQUIV	ANNUAL EQUIV		
4	REC $	APPRENT	TUITION REFUND	CONTINUING EDUCATION	DEPT NO	ACCOUNT NUMBER	BARGAINING UNIT SENIORITY UNIT DATE				

SALARY INFORMATION

5	CHANGE TYPE	NEW BASE SALARY RATE (U S DOLLARS)	PERIOD FREQ	AMT OF CHG	EFFECTIVE DATE	% CHANGE
	CURRENT					
	FIRST PREVIOUS					
	SECOND PREVIOUS					

PERFORMANCE REVIEW

REVIEW TYPE	DATE	RATING
CURRENT		
FIRST PREVIOUS		
SECOND PREVIOUS		

OTHER INFORMATION

6	EXMPT FED	EXMPT FICA	BENEFIT CODE	ADMIN SALARY GRADE	INSURANCE CLASS	MERIT REVIEW GROUP	SPECIAL PAY ALLOWANCE TYPE AMOUNT	SPECIAL PAY ALLOWANCE TYPE AMOUNT			SPECIAL PAY ALLOWANCE TYPE AMOUNT	ADDITIONAL JOB TITLE
7	EXMPT STATE	EXMPT LOCAL	RESIDENT COUNTY	PAYROLL CODE		ELIGIBILITY DATE	SPECIAL PAY ALLOWANCE TYPE AMOUNT	SPECIAL PAY ALLOWANCE TYPE AMOUNT	U S SALARY		PAYROLL INTER	DATE; COMPANY CREDIT CARDS 1 AIR 2 CAR 3 PHONE 4 5 6

CHRONOLOGICAL WORK HISTORY

8	EFFECTIVE DATE	TYPE CHANGE	BASE SALARY RATE	RATE PERIOD	JOB NO	JOB TITLE	LOCATION CODE	LOCATION NAME

OTHER INFORMATION

9				APPROVAL SIGNATURE HRC	MAIL CODE BLDG	[redacted]

FOLD HERE — FOLD HERE

EMPLOYEE NAME

EMPLOYEE PROFILE

01 | EMPLOYEE NUMBER | DATE CHANGE MADE

PERSONAL INFORMATION

10 — 002 FIRST NAME | MI | LAST NAME | [redacted] | 011 | [redacted]

11 — 025 LOCATION CODE | DATE IN LOCATION | LOCATION NAME | 017 | 016 | [redacted] | 092 CLASS

12 — 003 STREET AND NUMBER | 004 CITY | STATE | ZIP CODE | 005 SUPPLEMENTAL ADDRESS | 006 HOME TELEPHONE NUMBER

13 — 014 EMERGENCY CONTACT NAME | RELATIONSHIP | ADDRESS | 012 EMERG TELEPHONE NUMBER | 110 VISA STATUS | [redacted] | 140 VISA EXPIRE DATE

BENEFITS INFORMATION

14 — 033 ??? PLAN | EFFECTIVE DATE | COVERAGE | DEDUCTION | 034 ACCIDENTAL DEATH DISMEMBERMENT PLAN DATE | AMOUNT | 209 GROUP HEALTH INS PLAN DATE

15 — 038 TVL ACC PLAN | EFFECTIVE DATE | COVERAGE | DEDUCTION | 030 LONG TERM DISABILITY PLAN DATE | AMOUNT | 210 SAVINGS PLAN PLAN ELIGIBLE AMT

16 — 037 RET PLAN ELIG DATE | 039 RETIREMENT PLAN | PROJ RETIRE DATE | PROJ CRED ???? | 038 SEPT 1 RATE OF PAY | [redacted] | 150

FORMAL EDUCATION (SEE INSTRUCTIONS ON REVERSE SIDE)

17 — LEVEL | LEVEL NAME | YEAR | SUBJECT | SUBJECT NAME | SCHOOL | SCHOOL NAME | 214 | 141 HS DATE IRSE

HIGHEST

ADDITIONAL LEVEL 1

ADDITIONAL LEVEL 2

EDUC IN PROG | CREDITS OBTAINED | CREDITS NEEDED | 215 | 211

EDUCATION AND TRAINING COURSES (SEE INSTRUCTION ON REVERSE SIDE)

18 — COURSE CODE | DATE | DESCRIPTION LOCATION | DURATION | GRADE | TYPE | COURSE CODE | DATE | DESCRIPTION LOCATION | DURATION | GRADE | TYPE

PRIOR EMPLOYMENT/MILITARY HISTORY

19 — COMPANY NAME | FROM | TO | JOB TITLE/DUTIES | COMPANY NAME | FROM | TO | JOB TITLE/DUTIES

FORM 4745 02/7011

tried to do with the people who were reluctant to fill out certain information was to try to impress on them that it's to their benefit. In the past, they'd never gotten any feedback. On the old system we got notes from people saying, "Why am I doing this again?' So we called every one of them. You have to help them understand." According to Rondot, this effort was almost wholly successful.

Both Rondot and Loughrey emphasized their concern with insuring the accuracy of the data on HRS. "Bad information is worse than no information at all," argued Rondot. For this reason, 100% error-checking was performed on the initial data load. Once HRS was operational, it became imperative to make employees realize their HRS data was being used, so that they would assume responsibility for keeping it accurate. The system was vulnerable to deliberate falsification of data, since supervisor review was eliminated to avoid needless data proliferation and because supervisors were considered to have a limited right to employee personal data. Bob Evans stated that Cummins' exposure was greater from half-truths (e.g., claims to knowledge on the basis of limited experience) than from lies, for Employee Profiles were regularly reviewed in consultations with line Personnel representatives.

Another problem, according to one manager, was that slow updates caused information to degrade. Consequently, some managers preferred to use manual files or to ask employees for information about themselves. John Rondot disagreed. Files were updated two or three times monthly for payroll, he said; other data was entered once a week.

Interface with Other Cummins Systems

In mid-1976, the only automated systems with which the HRS interfaced were the payroll system (via an interface programmed by InSci) and the benefits/claims systems. Cummins anticipated buying InSci's Health Assurance System. HRS was being installed in the Charleston plant, and installation would begin shortly in England. Installation in Charleston was proceeding somewhat more slowly than at Columbus due to other priorities. Loughrey felt other plants were eager to get HRS, especially since Corporate's only requirement was that plants supply required data in the required format--beyond that, plants were free to use HRS as they wished. Loughrey and the team envisioned more complex interface requirements in the future (Exhibit 6).

The most important nonautomated interface was to the

Exhibit 6
CUMMINS ENGINE COMPANY
Major Users/Uses of Tomorrow's Personnel Systems

Some of these data needs will be satisfied when the package is installed, but others will require considerable additional work in the future to become a reality.

Job Posting System, redesigned and reinstituted on January 8, 1976, after a lapse of 18 months. (This system was also called the Exempt Job Announcement System.) The purposes of this system, according to Ted Marston's introductory memo to employees (Exhibit 7), were to improve job selection at Cummins and to allow employees more voice in determining their career paths. Job posting bulletins were sent to each employee in Cummins.

The evaluation of the Job Posting System was not yet complete in July 1976. However, except in cases of massive reorganization, virtually all professional jobs at manager-level and below were being posted. According to Marston, the system had gone a long way toward eliminating favoritism and politicking. A number of successful cross-divisional and other unusual moves had also occurred. The system had also helped spot employees who were unhappy in their assignments. Sometimes supervisors had refused to let them transfer; under the Job Posting, however, high-level approval was required to restrict employees from interviewing for posted jobs after 1 year on their current jobs. Because of the role HRS played in helping supervisors review applicant backgrounds, interviews per job had been cut from 12-15 to 3-5.

The most serious problem Marston saw in the Job Posting System occurred when desirable jobs were created for specific people (some of whom were new hires) without permitting present employees to interview. However, at least one middle manager said that job posting caused only disruption and was unnecessary in a company as small as Cummins. Although posting was required for certain job levels, this manager claimed, managers usually had chosen someone in advance. Also, according to this manager, posting low-level jobs was useless because no one wanted them. Since the HRS would probably never be kept up to date, in his opinion, this manager thought there was no real relation between job posting and the automated personnel system.

In late 1976, Cummins planned to begin using the career planning module of the HRS. According to an InSci brochure, "The Career Profile enables management to run a large company with much the same human touch that once prevailed when top executives could wander through an office or plant and greet every last member of the staff on a 'first name basis'." While the software and input forms for career planning had been available since system installation (Exhibit 8) employees were not asked to provide career-

Exhibit 7
CUMMINS ENGINE COMPANY
Memo Introducing the Job Posting System

Date:	January 7, 1976	Subject:	Exempt Job Announcement System
To:	Exempt Employees		

From: T. L. Marston
City: Columbus

As of January 8, 1976, the Exempt Job Announcement System will be reinstated.

The Job Announcement process is a part of the Selection and Placement System and is one of the methods that will be used to identify qualified people for open jobs.

The overall objectives of the Selection and Placement System are:

- To insure that the best talent available is considered for open jobs.
- To encourage more cross-divisional moves
- To allow more input from individual employees about their careers and jobs for which they would like to be considered.
- To develop better structure, fairness and equity in the selection and placement of people.

The following is an outline of the Job Announcement System and how it relates to you.

- The job announcement will be printed on Tuesday of each week and mailed to all employees on Wednesday. After the first few general job announcements, job postings may be placed on designated bulletin boards as opposed to all employee mailings.
- If you wish to respond to an announced job, you may do so by writing a memo (typed or handwritten) to the person designated in the announcement for that specific job. The announced job may be a higher or lower salary grade or a lateral transfer in relation to your current job.
- Your response may be informal and brief but should include name, current job you are applying for and any comments you wish to make regarding your qualifi-

cations for the job in question that you feel may not be available to the Supervisor through your Personnel Records of Employee Profile Data.
- The due date for responses to be submitted will be indicated on the job announcement.
- Your eligibility to respond to an announced job is determined by your salary grade and the length of time on your current job.

Salary grade	Minimum time-on-job
9 or 26 and below	18 months
10 or 27 through 13 or 27	24 months

*The first exempt job with the company will require a minimum of 12 months.

If you bid on a job and are selected to be interviewed, the process will be:
- Your supervisor will be contacted by your Division Personnel Department and advised of the request to interview.
- If a supervisor wishes to deny a request to interview he/she will present the rationale for the denial to the Division Director of Personnel & the Division Head for final approval.
- You will be advised by your supervisor when an interview request has been made. If the request was denied you will receive a full explanation from your supervisor.
- Each employee profile sheet will have a space indicating the month and year the individual has met the minimum time-on-job requirements.
- If you wish to respond to a job announcement and have not fulfilled your minimum time-on-job requirement, you must gain approval signatures from your immediate supervisor and Division Director of Personnel before your response will be considered.
- Class 8/26 jobs and below will be posted with few exceptions. Class 9/27 through 13 will be posted when it is considered useful and appropriate.

If you bid on a job and are not selected to be interviewed you will be notified in writing.

Exhibit 7

CUMMINS ENGINE COMPANY

Memo Introducing the Job Posting System (Continued)

If you have any questions regarding the Job Announcement System, you may direct them to a member of your Division Personnel Department.

In July 1976 we will review the job announcement process and make whatever changes might be necessary to improve it.

T. L. Marston/zca Vice-President--Personnel

Exhibit 8
CUMMINS ENGINE COMPANY
Career Profile

IMPORTANT—PLEASE REFER TO YOUR MANAGER'S MANUAL BEFORE COMPLETING THIS FORM.

Human Resource System

Foreign Languages - Description	Skill Code	Prof
1	045	
2	046	
3	047	

Foreign Languages - Description	Skill Code	Prof
4	048	
5	049	
6	050	

Training Needs Description	Skill Code	Mod
1	051	
2	052	
3	053	

Functional Work Preferences - Description	Skill Code	Mod
1	054	P F
2	055	P S
3	056	P T

First Career Objective Code	First Career Objective Description
156	184

Third Career Objective - Code	Third Career Objective Description
158	221

Second Career Objective - Code	Second Career Objective Description
157	220

Location Preferences		
222 1	2	3

Skills/Work Experience - Description	Skill Code	Yrs Exp	Last Year	
1	057			A
2	057			A
3	057			A
4	057			A
5	057			A
6	057			A
7	057			A
8	057			A
9	057			A
10	057			A

Skills/Work Experience Description	Skill Code	Yrs Exp	Last Year	
11	057			A
12	057			A
13	057			A
14	057			A
15	057			A
16	057			A
17	057			A
18	057			A
19	057			A
20	057			A

Type	Date	Achievements, Professional Licenses and Memberships Description
1 058		
2 058		
3 058		
4 058		
5 058		
6 058		
7 058		
8 058		

After completing change(s) please sign on reverse and forward to your supervisor

Special Experience			
106	107	108	109

126	127	128	129	138	139	168	169

Exhibit 8

CUMMINS ENGINE COMPANY

Career Profile (Continued)

Profile Date	Employee's Name	Location Code

career profile

01	Employee Number	Date Change Made

A — FOREIGN LANGUAGES

	Description	Skill Code	Prof
1			
2			
3			

FOREIGN LANGUAGES

	Description	Skill Code	Prof
4			
5			
6			

B — TRAINING NEEDS

Description	Skill Code	Mod

FUNCTIONAL WORK PREFERENCES

Description	Skill Code	Mod
		PF
		PS
		PT

C — FIRST CAREER OBJECTIVE

Code	Description

SECOND CAREER OBJECTIVE

Code	Description

THIRD CAREER OBJECTIVE

Code	Description

LOCATION PREFERENCES

1	2	3	

D — SKILLS/WORK EXPERIENCE

Description	Skill Code	Yrs Exp	Last Year	Actn

SKILLS/WORK EXPERIENCE

Description	Skill Code	Yrs Exp	Last Year	Actn

All changes and/or corrections to the information printed on this Career Profile should be made on the reverse side

To add one year experience, enter an X in Action column
To delete a skill, enter a 'D' in Action column
To add a skill, use reverse side of form

E — SIGNIFICANT ACHIEVEMENTS, PROFESSIONAL LICENSES AND MEMBERSHIPS

Type	Date	Description

SIGNIFICANT ACHIEVEMENTS, PROFESSIONAL LICENSES AND MEMBERSHIPS

Type	Date	Description

F — SPECIAL EXPERIENCE

LINE PERSONNEL ORGANIZATION COPY

Employee's and Manager's signatures must be entered below to authenticate changes on this and reverse side of form.

Form 4744

I CONSENT TO THE USE OF THE ABOVE DATA ON MYSELF IN THE CUMMINS HUMAN RESOURCE SYSTEM

Employee's Signature	Date

Personnel Manager's Signature	Date

Approval Signature (HRIC)	Date

planning data until Cummins was ready with its career counseling system. Starting in September, 1976, each exempt employee would meet with his line personnel representative at least once a year for a career-planning session. The HRS record would play a role in recording his progress, training requirements, and job preferences. According to Bob Evans, who in 1976 was a line Personnel manager in Management Systems, HRS should not replace Job Posting. Because an HRS search required no overt action on the part of the individual, the individual had no way of knowing whether he had been considered for any job opening when he was selected only by use of HRS codes. Evans believed HRS would continue to supplement the Job Posting System.

HRS and Privacy

The team's first task in installing HRS at Cummins was to decide what data to store. Because privacy had been a concern from the start, data element definition was completed in less than 2 weeks. John Rondot explained how the process worked:

> We put all the data elements on an overhead projector in front of all directors of Personnel and said, "OK, what do you think?" And they said, "We don't need this, and maybe it's not proper to keep that." And so that's how we did it. We had a session--there must have been 30 people there. We even had their staff.

By that time, the team had developed a set of generalized guidelines to safeguard privacy on the system. Joe Loughrey explained them in his testimony before the Indiana Privacy Subcommittee:

1 Limits and standards should be imposed for company collection, use, access, dissemination, and retention of personal data about employees.
2 Employees should have right of access and ability to correct or amend data stored about them, with a very few exceptions. "These would be considered exceptions simply because these are things that may or may not happen and are conditional on something else that has not yet happened...or cannot yet be adequately judged." Examples include plans for salary increases and management succession. Employees should know whenever anything in their records changes.

Employees should know what information about them is available within the company, and under what circumstances and to whom it may be released. It is not necessary to obtain consent to each such release if adequate checks control the internal release process. Controls should include a requirement for special approval before line personnel groups are permitted access to records of employees for whom they have no responsibility.

Except in response to a subpoena or other legal requirement and in the absence of a signed employee consent statement, the only personal data revealed outside the company should be dates of employment and most recent job title. If additional data are provided to satisfy legal requirements, the employee should be told, unless law prohibits the company from doing so.

Complementing restrictions imposed to prevent illegal discrimination, the company should limit personal data gathered and stored to that necessary to conduct business. Accordingly, Cummins no longer kept a record of the employee's relatives and friends within the company, previous addresses, spouse's name and place of work, wife's maiden name, or arrest record. In addition the decision was made not to use Social Security number as the primary identifier for employee records. Instead, the five-digit employee number was used on HRS.

Employers should not have access to employee medical records. However, the advice of the medical department may be sought by the Vice President of Personnel to determine potential impact of a proposed action. No medical data should be disclosed outside the company without the employee's written release or where required by law.

The company is responsible to the employee for the following things:

a Collecting only information necessary to the business or as required by law;
b Insuring that employees understand the purposes for which personal data is collected and stored;
c Informing employees how data about them is stored, accessed, and disseminated;
d Protecting privacy of employee personal information and releasing it only on a right-to-know basis or with the employee's written consent;
e Telling employees the procedures for reviewing and correcting or amending personal information;

f Eliminating obsolete, inaccurate, or irrelevant information.

Human Resource Information Center

To protect the security of the system, a Human Resource Information Center (HRIC) was established under Judy Copple, who had joined the team following the decision to buy HRS from InSci. Beginning in January 1975, Copple reported to Joe Loughrey, who became Manager of Human Resource Systems at that time. (However, she did not formally join the team until May 1975.) Judy Copple explained that HRIC was responsible for system security. However, employees had the option of addressing complaints and questions to either HRIC or their line Personnel representatives.

When HRS was being introduced, HRIC had store-front headquarters in a shopping center not far from the main office building. The remote location permitted HRIC workers to leave scattered around the numerous documents being transposed onto the system from employee folders and other sources. At the time of the layoff, clerical personnel were transferred to HRIC and trained by InSci. When HRIC moved in July to its new location in a remote area of the General Office Building, two of the original three clerks were still with the group. (The third had elected to change assignment through the hourly Job Posting System, since no restrictions limited job assignment after HRIC service.) Loughrey recalled that, after the system became operational, paper flow was dramatically reduced, eliminating the need to locate HRIC away from the mainstream. Virtually no casual traffic came to the new HRIC office, Copple said. Each HRIC employee had a key to the office; however, security guards prevented unauthorized access after working hours.

Security Procedures

Although reports were sometimes generated without proper authorization, they were never released until security procedures were observed. A line manager who wanted to see either an Employee Profile or a standard system report had to submit the request through his line Personnel manager. HRIC clericals knew all line Personnel people personally. To obtain authorization for a data search, managers had to complete a special form with blanks for the following data:

1 Description of report requested;
2 Purpose of report;
3 Report timing and frequency;
4 Name and title of persons using the report;
5 Request date;
6 Authorization signatures, including those of the Director of Personnel Administration and either the head of the manager's line Personnel group or a central staff Personnel Department head.

Normally, only one copy of an employee's Profile was generated for management review. However, if an employee applied for more than one position under the Job Posting System, multiple Profile copies were generated for managers who wished to review his HRS record. However, handwritten Performance Reviews were not duplicated; consequently, when an employee applied for several job openings, managers sometimes experienced delay in reviewing his performance history. To alleviate this problem, HRIC permitted managers to obtain the Performance Reviews directly from one another. This solution did not prove completely adequate, however, since managers still complained about the time required to get employee data. In addition, HRIC had some problems with supervisors who took excessive time to return records to HRIC or failed to notify the Center when they passed Performance Reviews to other managers.

Another security measure was to limit access to system information. Although the Manager's Manual provided instructions for completing report requests, only Judy Copple and John Rondot had copies of the User Manual and the dictionary of search terms for data retrieval. The dictionary was kept under lock and key. To avoid casual scanning, data input was encoded on diskettes at HRIC and hand-carried, along with keypunched report requests, to the computer center in a secure building elsewhere in Columbus. John Rondot said, "It takes two signoffs to mount the HRS master tape, including the signature of a supervisor of the data center. Still, signoffs alone don't stop the dishonest person. However, we have managed to build in a measure of security and control by having report requests routed through several different groups within the data center." Printed output was hand-carried from the computer center back to HRIC. According to both Loughrey and Rondot, security provisions for HRS were stricter than for the company's financial data.

Judy Copple acknowledged that, if data were printed at the computer center, security might be compromised. Therefore, a confidential printer was soon to be installed near the HRIC at the General Office Building. However, according to Chip Gulden, Computer Operations Manager, removing the printer from the data center would not restrict computer operators' future access to HRS data, while unusual security measures presently employed damaged data center morale, particularly among operators, without actually establishing system security. Alternatively, he suggested, Personnel could run its own system. Gulden had pointed out that security would improve if Cummins kept audit trails and notified employees not only for record update, but for all accesses as well.

In July 1976, John Rondot was the only Management Systems employee familiar with HRS, so programmer security violations were not a problem. Gulden kept whatever backup tapes Rondot requested. These tapes were stored in a vault in the data center. Master files were in the data center tape library.

Whenever an employee's record was updated, a new Employee Profile was printed and sent to him via confidential mail in the company mail. Cases had been reported of secretaries' inadvertently opening envelopes containing Employee Profiles, along with other mail; therefore, special, easily recognizable envelopes had been adopted. Profiles were sent by company mail, rather than to homes, because some employees did not wish to share data with spouses. Special paper inhibited printing of sensitive data in certain profiles (especially job applicant review profiles), depending upon report audiences and purpose. Certain data fields were printed only on the employee's copy of his Profile.

Once HRS system security was firmly established, Cummins planned to have HRIC implement all payroll-file changes; meanwhile, HRIC processed them in parallel with the Payroll Department. In addition, Cummins would reevaluate its decision not to use HRS capability to store performance ratings. According to Bob Evans, performance data in employee folders in Personnel was not consistent or clear enough to stand the test of automation. Some folder data were 15 years old; since employees had generally not responded to Personnel's written invitations to review their folders, it was hard to evaluate outdated material. Joe Loughrey would shortly head a committee to decide what to

purge from folders. Subsequently, folders would probably contain entire work history, current career development data, and a maximum of 5 years' performance reviews. A Management-by-Objectives (MBO) type of system was being installed, and, Evans observed, "The talking process in MBO is a lot more important than the formal, written evaluation."

Cummins did not impose penalties for violating HRS security measures. At least one manager said that the prevailing practice of free information exchange made it unlikely that the company would ever dismiss anyone for security violations. According to Loughrey, the requirement was not to punish but to teach the need for security. The company relied mainly on written materials for that purpose. Loughrey believed a letter from Cummins' president might be necessary to explain to supervisors that providing information about former employees to prospective employers outside Cummins violated company policy. Loughrey felt it essential to establish HRS security at Cummins to avoid abuses; if HRS were secure, it could help to preserve management in a "family atmosphere," he hoped.

As he considered the history of the Human Resource System at Cummins, Joe Loughrey wondered about the role it would actually come to play in the company. Why couldn't some line managers understand that their problems really weren't the fault of HRS? Why did they refuse to accept the simple fact that reports could be printed overnight? And how could they close their eyes to the fact that in the social climate of the United States in the 1970s, Cummins' risk in storing the personal data they wanted far outweighed any potential gains? Joe Loughrey wondered what he should tell Ted Marston at their meeting in 2 hours' time.

CASE QUESTIONS FOR DISCUSSION

1 Evaluate Cummins's decision to buy InSci's Human Resource System.
2 Who are the users of Cummins' HRS?
3 Is Joe Loughrey's concern with privacy and security excessive?
4 What should Joe Loughrey tell Ted Marston?

The Microfiche Index System

Debra Slotoroff

In 1976, Bill Johnson, of the Payroll Department of XYZ Corporation, became concerned about the time-consuming and labor-intensive task of maintaining documents on corporate personnel. As a result of the current process a backlog of paperwork occurred and the payroll specialists, Johnson's subordinates, have had little time to perform their other duties. Armed with his own research, Johnson, along with his supervisor, Ms. Joann Williams, consulted Roger Baker of XYZ's Information Systems Division on what could be done to alleviate the workload.

Background

XYZ Corporation, established in 1912, is the manufacturer of a number of household products: paper towels, soap, toothpaste, etc. The Company employs roughly 16,000 people in its headquarters in Metropolitan, New York. There are offices and plants located throughout the United States and Europe.

The Employee Information Division, of which Payroll and Personnel are a part, has the responsibility of maintaining documentation on employees at corporate headquarters. All the documents are either payroll or personnel related such as employee applications, payroll control vouchers and employee change notices. A sampling of these documents is presented in Exhibit 1. Originally, these documents were kept for three reasons: to fulfill a legal requirement, to verify the signatures that authorized the action and to perform certain payroll and personnel related functions based on the information taken from the document.

In the mid-1960's the Employee Information Division began microfilming the documents. This provided a more convenient means of retaining the documents without the bulk of paper. Prior to this, the original document was kept in an employee folder which, in turn, was stored in

Exhibit 1

XYZ CORPORATION

Payroll Change Voucher

MR / MRS / MISS — LAST NAME — FIRST — MIDDLE — SOCIAL SECURITY NO — EMPLOYEE NO — ☐ MALE ☐ FEMALE — TRANSACTION EFFECTIVE / /19

STREET — CITY — ZIP — HOME TELEPHONE NO

DATE EMPLOYED / /19 — BIRTH / /19 — MARITAL STATUS ☐ SINGLE ☐ MARRIED ☐ DIVORCED ☐ WIDOWED — SEND PAYCHECK TO ☐ DESK ☐ HOME ☐ OTHER (Specify)

EMPLOYEE STATUS CHANGE

☐ NEW EMPLOYMENT REGULAR	☐ RESIGNATION	☐ MEDICAL LEAVE	☐ PROMOTION	☐ TITLE CHANGE
☐ NEW EMPLOYMENT CASUAL	☐ TERMINATION	☐ PERSONAL "	☐ MERIT INCREASE	☐ NAME CHANGE
	☐ RETIREMENT	☐ MILITARY "	☐ SALARY ADJUSTMENT	☐ ADDRESS CHANGE
☐ REHIRE	☐ DECEASED	☐ MATERNITY "	☐ TRANSFER	☐ MARITAL STATUS
DATE OF PREVIOUS SEPARATION	☐ LAYOFF	☐ RETURN FROM		☐ OTHER (Explain in Remarks Below)
/ /19	☐ ADDITIONAL RATE	DATE OF LEAV FROM / /19 TO / /19		

DEPARTMENT OR DIVISION — ACCTG UNIT — LOCATION

CENTER NAME — CENTER NO — TYPE OF EXPENSE

FIELD OR HEADQUARTERS LOCATION

JOB TITLE OR CLASSIFICATION

SALARY RANGE MINIMUM $ ____ MAXIMUM $ ____ — POINTS

EVALUATION PROGRAM — JOB DESC NO — FLSA ☐ EXEMPT ☐ NON EXEMPT

POSITION STATUS ☐ ADDITION TO STAFF IN EXISTING POSITION ☐ NEW POSITION

☐ REPLACEMENT (EMPLOYEE REPLACED)

PREVIOUS POSITION ☐ ELIMINATED ☐ RETAINED

VACATION DAYS CREDIT (IF ANY) TO EFFECTIVE DATE OF THIS CHANGE ____ DAYS

DEPARTMENT OR DIVISION — ACCTG UNIT — LOCATION

CENTER NAME — CENTER NO — TYPE OF EXPENSE

FIELD OR HEADQUARTERS LOCATION

JOB TITLE OR CLASSIFICATION

SALARY RANGE MINIMUM $ ____ MAXIMUM $ ____ — POINTS — EFF DATE OF POINT CHANGE (MIP ONLY) / /19

EVALUATION PROGRAM — JOB DESC NO — FLSA ☐ EXEMPT ☐ NON EXEMPT

MR / MRS / MISS — LAST NAME — FIRST — MIDDLE

STREET — CITY — STATE — ZIP

SALARY CHANGE

HOW PAID ☐ WEEKLY ☐ SEMI MONTHLY

	RATE		BASE HOURS PER WORK WEEK	SHIFT NO	TWO PREVIOUS INCREASES DATE	TYPE	AMOUNT
FROM	$	PER			/ /19		$
TO	$	PER			/ /19		$

ESTIMATE OF TIME WORKED IN EACH STATE (for calculating State and Local Taxes)	% OF TIME SPENT	%	%	%	%
	STATE/LOCALITY				

SEPARATION STATUS

ADVANCE NOTICE GIVEN ☐ YES ☐ NO

TERMINATION ALLOWANCE ☐ YES ☐ NO

PAY IN LIEU OF { NOTICE ____ WEEKS; VACATION ____ WEEKS

CHARACTER OF SERVICE	WORK	ABILITY	CONDUCT	ATTENDANCE
VERY SATISFACTORY	☐	☐	☐	☐
SATISFACTORY	☐	☐	☐	☐
UNSATISFACTORY	☐	☐	☐	☐

DUE FROM EMPLOYEE (Explain how settled in Remarks)

TRUST FUND $ ____ ACC T REC $ ____ NOTES REC $ ____

AIR TRAVEL CARD ☐ YES ☐ NO CREDIT CARD ☐ YES ☐ NO

REMARKS

ENTER CODES: FUNCTION — SKILL — RACE

RECOMMENDED / /19	APPROVED / /19	APPROVED / /19
APPROVED / /19	APPROVED / /19	MEDICAL DEPT APPROVAL (MED L/A ONLY) / /19
APPROVED / /19	APPROVED / /19	REVIEWED (PERSONNEL) / /19
PAYROLL DEPARTMENT (Indicate when salary action will be included on check) / /19		VOUCHER RECORDED IN PAYROLL BY / /19

1 PAYROLL

Exhibit 1 (Continued)
XYZ CORPORATION
Employee Thrift-Investment Plan

CORPORATION

APPLICATION AND AUTHORIZATION TIP - 1

TIP P.R. OFFICE | SOCIAL SECURITY NUMBER

TYPE OR PRINT IN INK ALL INFORMATION - LOCAL PAYROLL WILL FILL IN ALL SHADED AREAS

DO NOT KEYPUNCH

CC 1,1 | EMPLOYEE'S LAST NAME | FIRST | I | DATE OF BIRTH / / | DATE OF EMPLOYMENT / /

CC 1,2 | ADDRESS NUMBER STREET | CITY | STATE | ZIP CODE | STATE RES CODE

I Hereby Certify that I Understand the Thrift - Investment Plan and Its Regulations and that I Apply for Participation in the Plan in Accordance with Its Terms Effective the First Day of MONTH | YEAR 19

CONTRIBUTION RATE

I elect to contribute to each class the percentage of my annual base compensation rate circled below.

CIRCLE ONE

1 [2%]
2 [4%]
3 [6%]
4 [8%]*
5 [10%]*

*NOTE: Percentage automatically reduced to 6% on annual base compensation in excess of \$15,000; up to \$15,000 indicated % will apply.

and hereby authorize the necessary payroll deductions (calculated to the nearest whole dollar) under the Plan. I understand that the percentage specified will remain fixed until change is requested but not sooner than 6 months after the effective date of participation or change in investment formula.

CHOICE OF INVESTMENT FORMULA

I direct that my contributions be invested by the Trustee(s) as indicated below in accordance with the provisions of the Plan. I understand that the investment formula specified below will remain fixed until change is requested but not sooner than 6 months after the effective date of participation or change in contribution rate.

Insert % (must be multiple of 25%)

_____ Stock Fund

_____ Guaranteed Fixed Return Fund

_____ Diversified Equity Fund

_____ U. S. Government Securities Fund

100% Total

BENEFICIARY

In accordance with the provisions of the P I hereby designate as my beneficiary in the event death

LAST NAME | FIRST | IAL

RELATIONSHIP

ADDRESS | NO | STREET

CITY | STATE | ZIP CODE

WAIVER OF PARTICIPATION

I do not wish to participate in the Plan but understand I may do so at a future date if I remain eligible.

CC 1,3 | ACTION CODE | CODE | CONTRIBUTION RATE MONTHLY DEDUCTION AMOUNT \$ | INVESTMENT FORMULA CODE

LOCATION:

EMPLOYEE'S SIGNATURE

DATE

SPOUSE'S SIGNATURE (COMMUNITY PROPERTY STATES)

DATE

PERSONNEL APPROVAL

DATE

PAYROLL APPROVAL

DATE

TIP-1 (10-79)

CORPORATE EMPLOYEE INFORMATION CENTER

a file cabinet. The amount of space required for these folders was becoming overwhelming for the department. Transferring to the process of microfilming the documents greatly reduced the space needed. Although the images of the documents were still stored in the folders the size of the microimages afforded the storage of more documents per folder. The payroll specialists would microfilm the documents as they came in, and the microimages would be cut and placed in the appropriate employee folders. The paper document was then destroyed. The folders were arranged in alphabetical order by the employee's last name. (Hereafter, micro-document will refer to the microimage of the original, unless otherwise specified.)

As in the original process, whenever a particular document for an employee was required, the payroll specialist would have to go through each individual micro-document on file for the specified employee to locate the one requested. When the user was finished with the micro-document, it would be placed back in the appropriate folder and the folder returned to its position in the file cabinet.

All of the folders were kept in any of 10 file cabinets in a room within the payroll area. A layout of this room is shown in Exhibit 2. Also in the room were two film developers, two microscopes (to test the quality of the developed film) and a small file drawer containing a cross-reference for employees who may have changed their last names.

In 1970, the Payroll Department devised a new method of maintaining the documents which is still in use today. A "personnel jacket" was created into which the microimages of each employee's documents were inserted. The collection of these microimages in one jacket constitutes what is called a "microfiche". An example of a microfiche jacket is shown in Exhibit 3. This eliminated loose images in the folders, although the documents for a particular employee are inserted in a random order. As with the prior methods the jackets are placed in the file cabinet in alphabetical order. This new method tremendously reduced the amount of space required, since the file cabinets used in the present method (7" x 4") are smaller than the former ones (15" x 12").

In addition, this new system of maintenance easily lent itself to separating out active and inactive documents. In particular only the most recently jacketed documents need to be in the active file; the others are kept in the inactive

Exhibit 2
XYZ CORPORATION
Room Layout

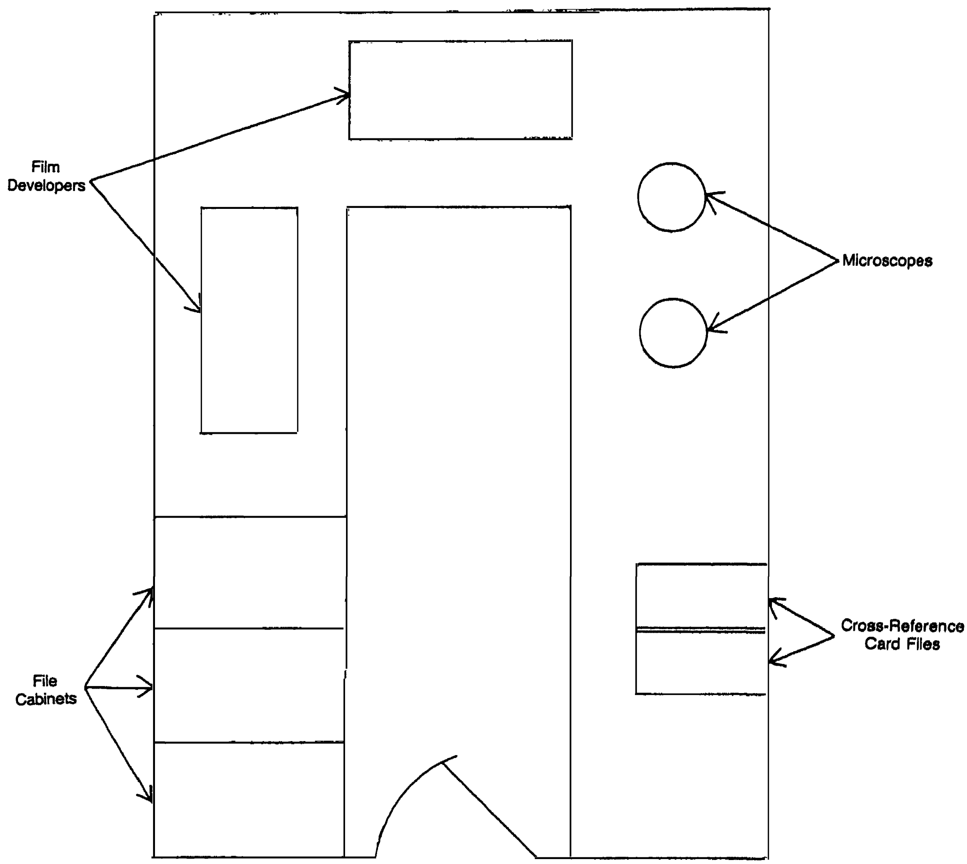
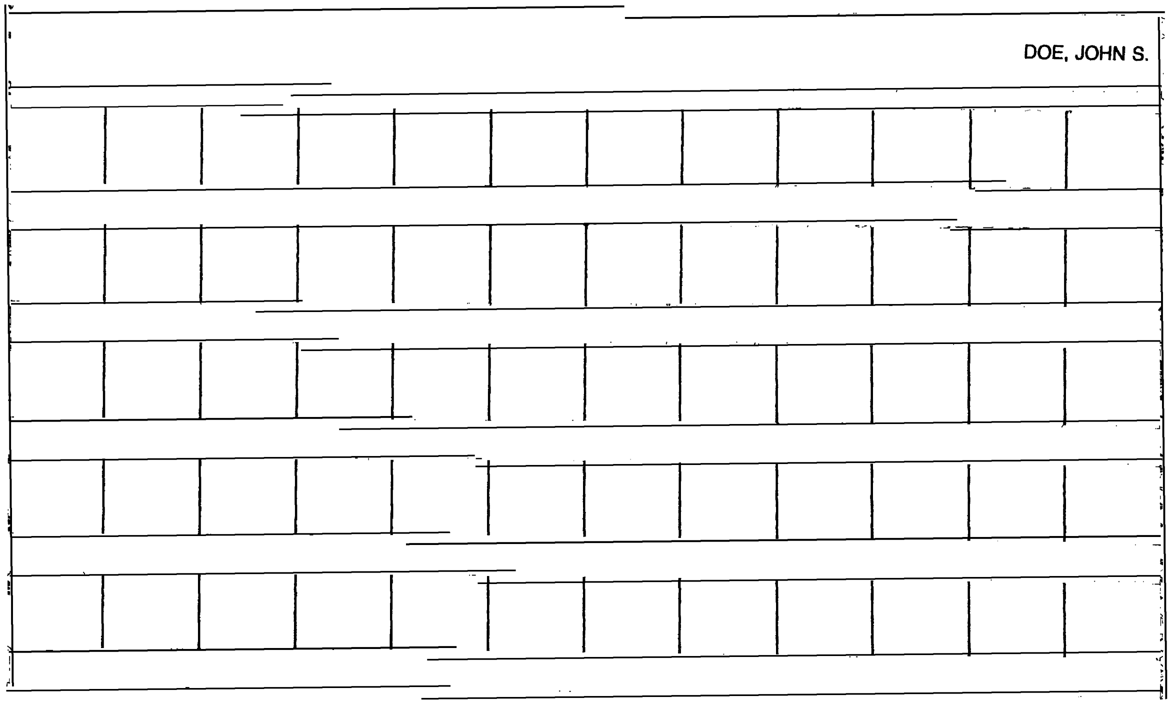


Exhibit 3
XYZ CORPORATION
Microfiche Jacket



file. Jackets for employees who have retired are also kept in the inactive files. Both sets of files are arranged alphabetically.

Each employee has at least one microfiche jacket which can contain up to 60 frames. The documents are placed in the jackets in the order of their receipt (i.e., the last frame inserted in each jacket is the most recent transaction document of that employee).

The present operation is completely manual. There are no process descriptions or written procedures for performing this function. As it exists today there are no reports or listings generated. Maintenance of the documents is as follows:

- The Microfilm Section of the Payroll Department receives the personnel or payroll document after it has been validated.
- The forms are sorted into alphabetical order before filming. Normally, the documents are batched into groups of 300 (the capacity of a roll of film).
- The sorted documents are filmed and the film developed. Usually filming occurs within one to three days after receiving the documents in the Microfilm Section. During peak periods backlogs occur so that sorting and filming are not completed until at least one week after the document is received.
- Particular employee microfiche jackets are pulled from the file cabinets after matching against the documents, and are held aside waiting for the film to be developed.
- The developed roll of film is then inserted into the proper jackets and cut at the end of the frame(s) making up the appropriate document.
- The jackets are copied for back-up purposes. Therefore in case of microfiche destruction at headquarters, the entire file cabinet of documents can be replaced.
- The original employee microfiche jackets are then refiled in the file cabinets in alphabetical order.

A diagram of the above process is presented in Exhibit 4.

The retrieval process is a tedious frame-by-frame search conducted by the payroll specialists. In particular:

- The file cabinet at headquarters is accessed by employee last name and all the jackets for that employee

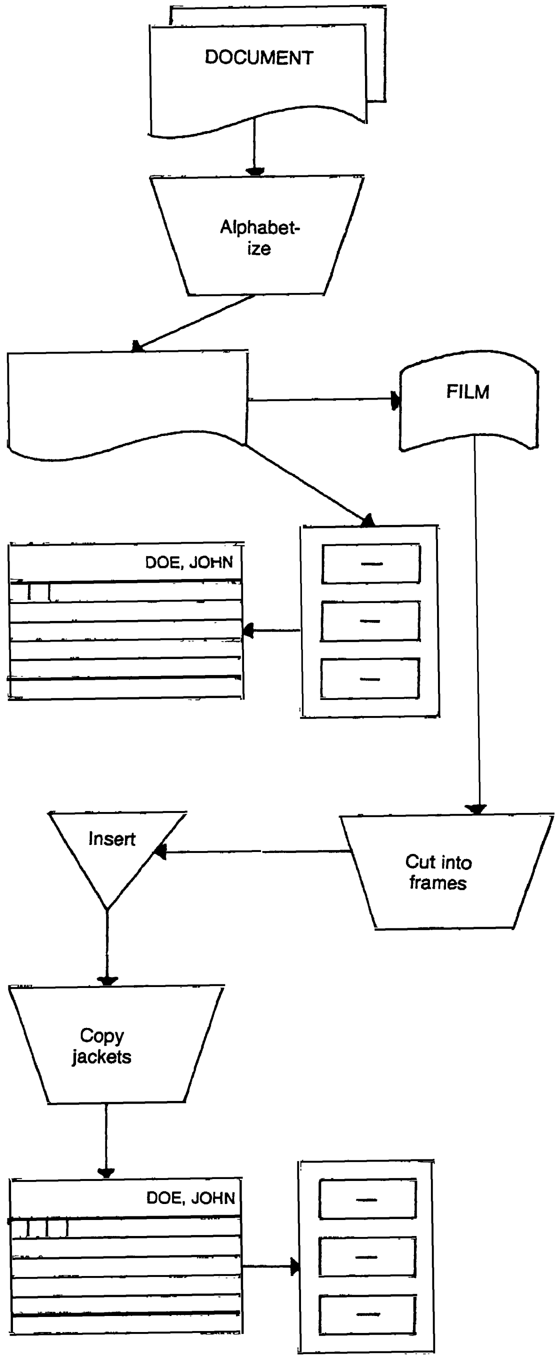
Exhibit 4

XYZ CORPORATION

Current Microfilm Processing

Time Line	Steps
Day 1	Documents are received and validated.
Day 2	Microfilm clerks alphabetize the documents.
	Sorted documents are filmed.
	Employee microfiche jackets are pulled from the file cabinets.
Day 3-4	Insert film into jackets.
Day 4-8	Copy the jackets for back-up.
	Refile jackets into file cabinets.

Flow



are withdrawn from both the active and inactive files.

- The most recent employee jacket for that particular employee is placed in the reader. Since there is no index of documents for the jacket, the payroll specialist goes to the most recent document (the latest frame) and searches frame-by-frame through each jacket for the required document.
- At the completion of the search and use of the jacket, it is returned to the file cabinet along with the other jackets for that employee.

A diagram of this process is found in Exhibit 5.

The copied jackets (back-up) are stored in file cabinets at another XYZ plant. However, they are not interfiled. Consequently, they retain an association with the jackets at headquarters, but are not accessible alphabetically or by social security number. In addition, since a copy of the jacket is made every time a document is added, there are multiple copies of the documents in the jackets within the back-up file.

If anything should ever happen to the jackets at headquarters, the payroll specialists would have to search through all the back-up jackets until they found the most recent copy of each of the original jackets. These copies would, in turn, be copied for a new back-up and the old back-up filed alphabetically in the file cabinets at headquarters. All older copies of the original jackets could be discarded. From this point on, the process of document maintenance would resume to the way it was before the disaster. The time to recreate the jackets is estimated at one day to two weeks. Thus far, no such incident has ever occurred.

Presently, the system includes approximately 30,000 jackets with a document count approaching one million. On average, there are 25 documents per employee. The greatest number of documents for any employee is 300. Each jacket can hold up to 60 frames. A document may take up any number of frames, where each frame represents one page of a document. Usually, the documents are only one page. Projected growth figures for fiscal year 1982 are 20,000 employees or 25%. Progression of this growth since 1960 is shown in Exhibit 6. On average the Microfilm Section receives 1500 documents per week to be processed. Cost elements for the present system are given in Exhibit 7.

Exhibit 5

XYZ CORPORATION

Current Microfiche Retrieval

Steps	Flow

Retrieve Employee jackets from file cabinets.

Place jackets in microfiche reader. Inspect each frame to find the specific document.

Return the jackets to the file cabinets.

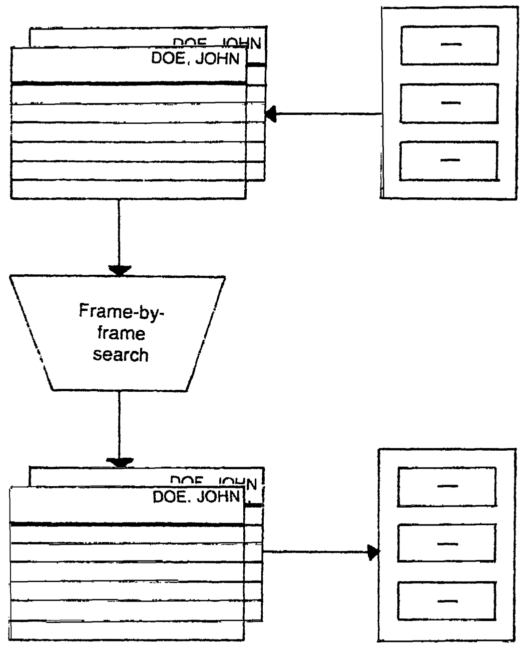


Exhibit 6
XYZ CORPORATION
Growth in Personnel since 1960

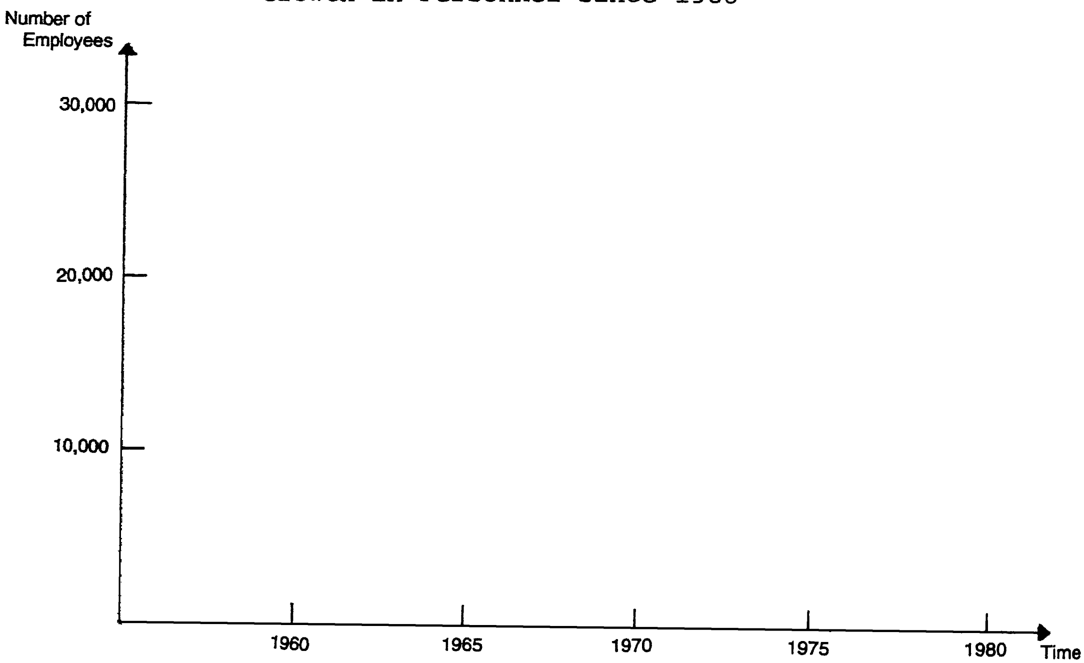


Exhibit 7
XYZ CORPORATION
Costs of the Current System

Personnel	Annual cost
2 payroll specialists	$28,000 (including benefits)

Equipment & Supplies	Annual cost
Microfilm	$ 200
Chemicals	500
Microfiche jackets	750
Diazo copy process materials	5,000
Total cost................................	$34,350

Plans for Change

Recently it has become clear that improvements on the present procedures are necessary if the payroll specialists are to maintain the microfilm records in a cost effective and timely manner (i.e., current). In particular the current process is often time consuming without an accompanying increase in efficiency. In addition the cost of materials, as well as those of labor and file cabinet security, are very high. Finally and most important, there is a projected growth factor of more than 25% over the next three years. If operations continue as they exist today, the only possible solution to accommodate this growth would be to add to the personnel already handling the maintenance function which would, in turn compound the cost problems.

As a result, Baker has undertaken a project to alleviate the workload of the document maintenance function and has initiated research into the background of that problem. As a preliminary step he has sought information from the ultimate users through interviewing. In an attempt to define the scope and direction of this project excerpts of Baker's conversations with Johnson, the manager of the Payroll Department, and his supervisor, Williams, were recorded.

Williams: The system we have now consists of segregating the incoming documents by employee. Since there is not necessarily a relation among a particular employee's documents for our purposes, we now propose microfilming these documents and storing the microimages in the order in which they are received, without preliminary sorting. In order to keep track of where the particular documents are located in the file cabinets, an index to these locations could be developed.

Bill Johnson and I have studied at some length a new microfilm system that would achieve this end with computer assistance. The purpose of the new system is to replace the present employee document microfilm function. We would like to reduce the labor intensity of the function of maintaining the documents. Although we would continue the microfilming of the documents, we feel that by creating an index which retains a close association with the file cabinet, we would eliminate some of the present tedium of the function. In particular, both maintenance and retrieval would be easier and faster. We are hopeful that a new system might be de-

veloped to be an extension of our other on-line systems. However, we realize that this may not be feasible.

Response time is not crucial since requests are so infrequent (on average, 5 per week). We would like to at least maintain, if not upgrade, the present level of integrity and security.

Johnson: First of all, we should install a microfilm index system on the corporate computer. This will streamline the entire operation. Documents can be filmed and inserted by the payroll specialists as they are received in the Microfilm Section without sorting. Information, such as name and document type, and the location of the document can be entered into the computer. By consulting the index it is a simple matter to find any document in the file cabinet. We could use a software package that has been developed by U.S. Data Corporation: the Index Management System (Exhibit 8).

Second, we don't need to convert all the old files to the new system. We can maintain the current microfiche jackets for historical purposes only.

Third, installing a new microfilm camera would speed up operations considerably. There's one available, an automatic feed, dual lens, rotary camera that will create, in one pass, the master and back-up copies of the original document. This will shrink material costs to under 2¢ per document.

Finally, we should upgrade the position of payroll specialist. This is not a simple file clerk operation. It is a record keeping responsibility requiring a well-organized, highly motivated staff. Upgrading the position will permit us to attract and keep competent people.

The way I see it we could design the screens for the on-line system something like this (Exhibit 9). It would be on-line for easy updating and instant response. The operator entering the information could do data entry directly from the jacket. That is, he/she could have the jacket in a reader on one side and a CRT on the other. We should get a listing every day of all the transactions that were entered into the system the day before. These would be checked against the actual jacket to ensure correctness. In addition, an index of all the entries could be generated in hardcopy once a week to be used in an emergency when the computer is unavailable.

With the material presented, Baker, the programmer/analyst set out to design the new Microfiche Index System. As his

Exhibit 8

INDEX MANAGEMENT SYSTEM

The Index Management System (IMS)*, developed by Datacorp, provides a method of maintaining indexed information on COM microfiche. The actual master index is kept on one or more microfiche while the supplementary data is maintained on a separate set of fiche. The master fiche which is updated periodically consists of identifying information to the rest of the associated data along with the locations within the remaining fiche. For example if a customer's account number is considered to be key to the other information kept on the customer, then the master fiche would have each customer's account number along with pointers to the other fiche containing information on that account. The user is allowed the option of either retaining all occurrences in the files of a particular account or erasing outdated occurrences and pointing only to the most current information.

Another feature of IMS is the capability of managing more than one data-file. Therefore, a report may be created based on a series of independently maintained files. As an example, if the account number from the above example points to customer name in one file and inventory in another, a report may be generated listing the names of all customers who purchased a specific item of inventory. This thereby ties the customer file to the inventory file.

Still another feature of IMS is the ability to cross-index information with many look-up sequences. In other words, rather than cumbersome sorting of the database, IMS allows the user to sort the index. Using this sorted index the job of locating a file in a sequence other than the original key is made possible.

Finally, the IMS master index may be used as a database. By including vital information, the IMS index becomes a mini-database. Often used information is detailed in the index to a level which precludes the necessity of further search. Information needed less often or in more detail may still be found in the supplementary data fiche via the index.

In effect, IMS affords greater flexibility in the utilization and application of information maintained on COM microfiche. This frees the programmer from regimentation in designing an information system.

*This should not be confused with Information Management System (IMS).

Exhibit 9
MICROFICHE INDEX SYSTEM
Input Screen

Social security number	Document type	Effective date	Location
012-10-1234	ECN	4/14/79	102234
013-20-5678	ECN	4/12/79	102235
014-30-9012	PCV	4/15/79	102236
015-40-3456	ECN	4/09/79	102237
016-50-7890	TAX	4/14/79	102238
017-60-1234	APP	4/13/79	102239
018-70-5678	PCV	4/11/79	102240
019-80-9012	ECN	4/15/79	102241
020-90-3456	ECN	4/13/79	102242
021-00-7890	PCV	4/07/79	102243
022-10-1234	TAX	4/10/79	102244
023-20-5678	MEM	4/01/79	102245
024-30-9012	TAX	4/07/79	102246
025-40-3456	APP	4/13/79	102247
026-50-7890	ECN	4/14/79	102248
027-60-1234	ECN	4/01/79	102249
028-70-5678	PCV	4/13/79	102250
029-80-9012	ECN	3/30/79	102251
030-90-3456	ECN	4/17/79	102252
031-00-7890	PCV	4/12/79	102253

analysis of the situation progressed, Baker acknowledged a number of obstacles.

Baker: I think I understand the situation as described by Williams and Johnson. However, there are a few problems that have come to my attention. Specifically, my boss has made the decision to install a new IBM software package which is designed to perform update and retrieval functions. This package, Application Development Facility (ADF--Appendix), seems to be well-suited for the Payroll Department's problem. My boss feels it would be a good "test project" for the new system. The only alternative which could be considered is foregoing the ADF package and using "pure IMS (Information Management System)" to program all the necessary functions. (The two alternatives are costed out in Exhibit 10).

Johnson's Index Management System was discarded primarily because it would be too 'project specific'. That is, it would be greated solely for the use of the Microfilm Section's problem and would probably not be usable in other areas of the company.

In addition, I see some problems developing with Johnson himself. Prior to his present position in the Payroll Department, Johnson worked with the information system representative for client services. That is, he dealt directly with the programmer analyst who developed systems for Payroll. With this experience, Johnson appears to feel qualified to design the needed system on his own. Some of his preliminary designs seem workable. However, I don't think he really needs all that he wants.

Based on the information he collected, Baker went on to design and develop the required system.

APPENDIX:
Application Development Facility (ADF)

The basic concept behind the Application Development Facility (ADF) is to standardize application development for the programmer. In effect, there are a limited number of tasks any program will perform. ADF provides an environment for the programmer to incorporate these tasks with minimum effort, to produce the application. ADF is in essence application software to the Information Management

Exhibit 10
APPLICATION DEVELOPMENT FACILITY
versus INFORMATION MANAGEMENT SYSTEM
Developmental Costs

	Amount	Mandays
Application Development Facility	$32,500	154.1
Information Management System	$35,200	167.1
Total difference (IMS - ADF)	$ 2,700	13

System (IMS) database management system. It enhances the IMS environment and ultimately minimizes the amount of time required for application development.

This is done primarily with the use of standardized screens. These screens are formatted with specific information by the individual designer. This along with the application logic is the major ingredient to application development with ADF.

The application logic is most often specified to ADF with the use of "rules". There are two basic types of rules: static and dynamic. "Static rules" as the name implies are enumerated at the start of the application design and remain unchanged. They dictate what the database and screens look like as well as what functions will be performed in the particular application.

On the other hand, "dynamic rules" determine the action flows in the application. For instance, they specify who is authorized to perform which functions and reject any unauthorized users. They aso specify what should happen if an error occurs in input or processing.

The database is designed by means of a series of statements: SYSTEM, SEGMENT and FIELD. The format of these statements is dictated by ADF. The SYSTEM statement defines the parameters which are used throughout the application. In effect, it identifies the application. The SEGMENT statements outline the segments to be used in the hierarchical design unique to IMS databases. The FIELD statements detail the variables contained in each segment. The basic sequence of these statements is:

```
SYSTEM
   SEGMENT 1
      FIELD A
      FIELD B
         .
         .
         .
   SEGMENT 2
      FIELD C
      FIELD D
         .
         .
         .
```

Based on the information found in the dynamic and static rules and in the SYSTEM, SEGMENT and FIELD statements,

the ADF screens are tailored for the application. Specifically, there are five major screens provided with ADF: Sign-On, Primary Option Menu, Secondary Option Menu, Key Selection Screen and Segment Display. The Sign-On screen is the first screen the user sees. He/she enters his/her id and the appropriate project and group code. This is checked against a database which maintains authorizations for all users. If all the information is correct the next screen to appear is the Primary Option Menu. This allows the user to select the transaction he/she wishes to process. If the user is authorized to perform the function he/she has selected, the next screen, the Secondary Option Menu, appears. This screen displays all the segments the current user is allowed to manipulate. Once a segment is chosen, the Key Selection screen appears. On this screen the user specifies which occurrence of the particular segment he/she wishes to see. For example, if the segment type is employee, Jones may be a desired occurrence. Finally, the Segment Display screen for the specified segment occurrence is made available to the user. Once all processing is complete, the user returns to the Primary Option Menu and ultimately signs off the system. Although there is a standard format for each screen provided with ADF these screens may be redesigned to suit the user in his/her application.

The ease with which programming may be accomplished with ADF is the primary benefit of using the system. To an extent, it eliminates the need for a programmer to be trained in a high-level language.

Bay Markets Corporation (A)

Cyrus F. Gibson

> Any computer manager who's worth his salt wouldn't let that situation go unnoticed by top management. You've got a responsibility to <u>do</u> something!

Ron Caldwell, head of Information Systems Operations of Bay Markets Corporation, faced the consultant of Peninsula Associates who was speaking to him. He looked around the conference room at the other Peninsula people with a nervous smile during the silence that followed the accusation. Everyone seemed to agree with the speaker.

Ron had not expected to be on the hot seat like this. On the foggy Friday in late February that he and Al Daniels had driven to Palo Alto from their offices in Oakland they had chatted about the problem of maintenance that was frustrating them both. They agreed that at best the consultant's presentation might give them some new insights. But now Ron found himself confronted with a personal challenge by an associate of the consultants who had recently interviewed him, Al, and a few others in the Informative Services group at Bay Markets Corporation.

The challenge would give Ron a lot to think about over the weekend.

Company Background

Bay Markets Corporation is a supermarket and retail chain store company with sales well in excess of $500 million and headquartered in Oakland, California. The origins of the company go back to the 1940s when six independent grocery store owners in the San Francisco area joined together to create the "Calthrift" grocery company. In the early 1950s Calthrift established a policy of lowering gross margins to 14%, significantly less than the 22% prevalent in food retailing. The creation of low-margin, high-volume merchandising resulted in explosive

growth in sales and the number of stores. The geographical distribution of Calthrift extended throughout the state, and into Oregon and Nevada.

By 1966 a group of Calthrift stores in the Bay area that accounted for nearly half of total sales of Calthrift broke away from the company and incorporated as Bay Markets. Sales and earnings for Bay Markets more than doubled from 1966 to 1972 (see Exhibit 1), reflecting the benefits of not only the low margin policy, but policies aimed at greater efficiency of operations. Bay Markets came to be known in the industry for its relatively high levels of sales per supermarket and sales per square foot.

In 1972 the company suffered a sharp earnings decline, largely as a result of increased price competition and increases in labor and other costs that affected the entire industry. Although the decline had a serious impact on earnings per share, top management had foreseen the difficulty and considered successful their efforts to reduce costs and expenses as much as possible during the year.

Bay Markets was organized into divisions by line of business. In addition to the chain of supermarkets of the Pricelo Division, which contributed 75% of 1971-72 sales, the company owned a chain of department stores and other smaller chains of stores including "home service" (do-it-yourself centers and catalogue centers). Divisions were highly decentralized with autonomous decision-making authority in virtually every aspect of their businesses.

Development of MIS

When Bay Markets broke away from Calthrift in 1966 it found itself faced with the need to develop quickly its own physical, operational and managerial capabilities for buying, warehousing and transporting goods to its stores, as well as providing other services such as EDP which had been provided centrally by Calthrift. Responsibility for these developments was given to Mr. Bernard Gold, one of the few managers at that time who was not a specialist in merchandising. In January, 1968, Gold hired Stan Grant to help in the planning, organizing and staffing for new facilities construction and operations. In October of 1968 Grant was made head of EDP by Gold, who saw the need to build up that function and to allow himself to concentrate on real estate. Under Grant was Harry Brown, an accountant

turned systems analyst/programmer, who had run EDP and had introduced important computer applications in the areas of accounting and payroll.

The period from 1968 to 1972 was one of steady development in the application of the computer as an aid to operations. One of the first applications was the grocery distribution system, which came on line in 1968. The system handled all aspects of ordering and distribution from the receipt of orders from stores to the printing of labels for cases. Its features included cost-optimization of loading pallets and trucks and the reordering for warehouse replenishment. The system made it possible to turn inventory 28 times per year in the stores and 48 times in warehouses, a significant improvement over previous turnover. Orders received in the morning were on the way to stores between 4 o'clock in the afternoon and 6 o'clock the next morning. Similar systems for frozen foods and non-foods were added later. By mid-1972 there were 32 major separate applications systems in operation.

As one MIS manager described this period, "There was a tremendous emphasis to get things done, get applications on line and get useful data to the users." The MIS budget for these years averaged nearly 0.4% of sales as compared to 0.27% for the industry as a whole. As more applications were developed there was a shift in the proportion of MIS budget expenditures away from development and toward operations. Operations represented less than 50% of the budget in 1969, and had climbed to 75% in 1972. According to Stan Grant the MIS department, known as Information Services at Bay Markets, achieved a considerable reputation for its rapid and innovative applications developments. Grant described the period as one in which the department was "on the cutting edge of applications," and pointed out that "the computer operation runs the business."

In 1970 the top management of Bay Markets hired the nationally known management consulting firm of Marshall Associates to evaluate its operating policies and procedures. In its report, which was generally highly favorable, Marshall mentioned as one of several minor criticisms the fact that the EDP budget as a percent of sales was above the industry average. In 1972 Stan Grant sponsored an examination of the organization and operations of Information Services by the local consulting firm of Peninsula Associates, which specialized in advising on the management

Exhibit 1

BAY MARKETS CORPORATION (A)

Relative Financial Statistics (1966 = 100)

	End of October				End of January		
	1966	1967	1968	1969	1971	1972	1973
Sales	100	112	126	134	175	207	254
Earnings	100	152	192	140	178	220	093
EPS--fully diluted	100	151	185	134	168	200	089

of computer-based information systems. The study reported a "clean bill of health," with only some minor recommendations. The most significant of these was a recommendation to transfer some systems analysts to functional areas in the user divisions, in order to provide a better input of user needs when designing systems.

MIS in 1972

The organization of Information Services in mid-1972 is given in Exhibit 2. As Director, Stan Grant reported directly to the Vice President of Distribution and Services, Mr. Carl Abel, whose other responsibilities included warehousing and transportation. The two largest units reporting to Grant were Systems Planning and Development (SPD), headed by Tom Johnson, and EDP, headed by Harry Brown.

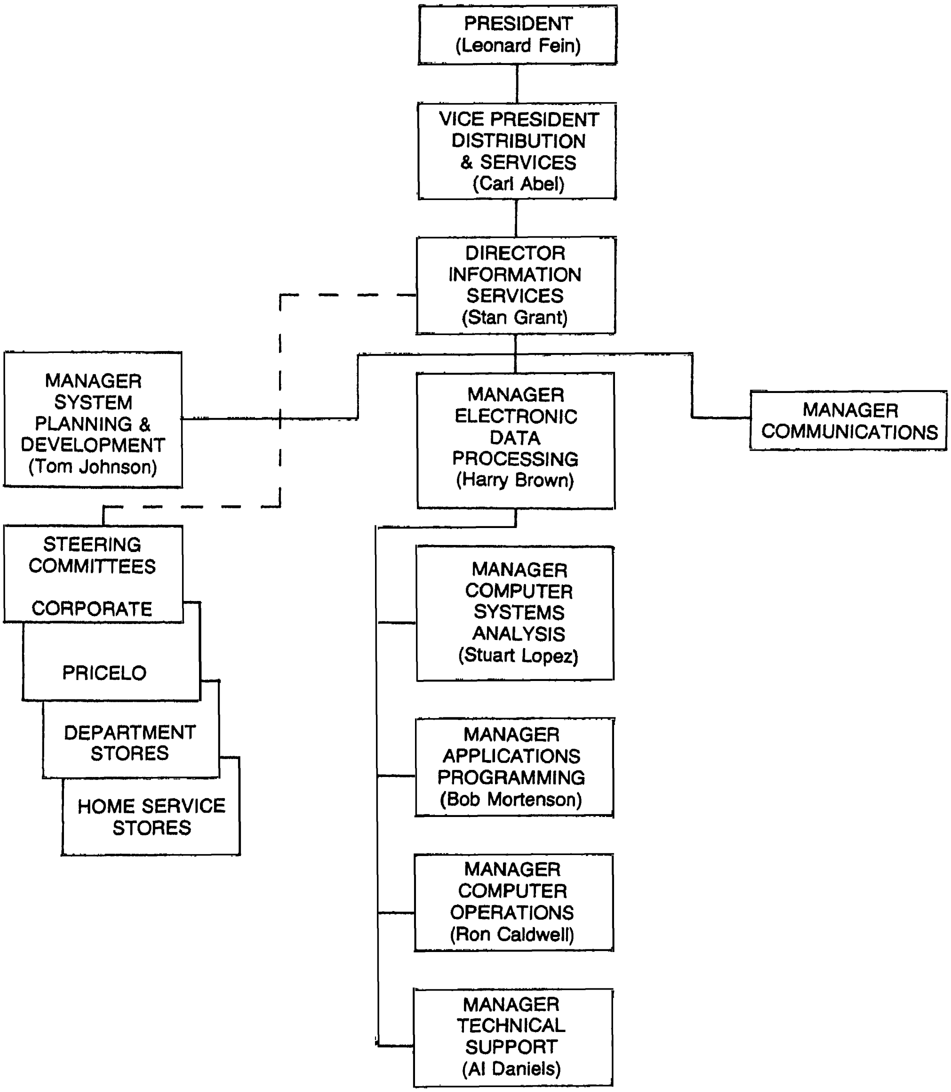
Tom Johnson had 15 systems analysts reporting to him. Their responsibility was to receive requests from users and turn these into requests for new applications or for "maintenance" changes to existing applications systems. When a project was defined by an SPD analyst and approved in the appropriate divisional steering committee, it was turned over to Brown's area. It went first to Lopez's computer systems analysis group, consisting of 10 computer analysts. There it was further elaborated and computer and programming specifications were prepared. These became the guidelines for the actual writing of computer code by the programmers in Bob Mortenson's Application Programming Group, consisting of 30 programmers and two project leaders. If changes were required in a project, or if problems or delays arose at any point, it was expected that the person in each group in the development chain who had worked on the job would be contacted and would revise his part of the sequence as necessary. In other words, responsibility for applications or changes were passed from one functional group to the adjacent one in the sequence described.

Ron Caldwell's responsibilities included hardware operation, keypunching and computer scheduling. Reports and other output from Operations went to users in all parts of the corporation. Much of this output, such as the daily grocery distribution runs, were critical to operating the business. The company leased a 360/50 running DOS/MFT and a 370/155 running OS/MFT. There were some 60 personnel in Operations, primarily keypunch operators and computer operators.

Exhibit 2

BAY MARKETS CORPORATION (A)

Organization for Information Services--Early 1972



Al Daniels' responsibilities in Technical Support were to monitor developments in hardware and operating systems, make recommendations on new equipment or changes that might be required by a growth in CPU needs or that offered cost savings advantages over existing systems, support and maintain operatings systems, provide technical advice to other groups in Information Services, and educate MIS personnel in the use of new systems. Working under Daniels were eight systems programmers and analysts.

Grant and Brown had been with Bay Markets longer than any of the other key managers, six and nine years, respectively. Grant was 54 and Brown 44. Tom Johnson was 42 and had been with the company 15 years. Lopez and Mortenson were each in their late thirties and with the company five to seven years. Brown considered them key to the continuing success of applications efforts. Al Daniels was 35 and had been with Bay Markets for a year.

Ron Caldwell, at 28, was the youngest of this group. He had been with the company and in his job for less than a year. During his short tenure, he had focused his efforts on the basis of his production unit, and had sought to streamline the various tasks his department was required to perform. Among the projects he had undertaken were a standardization of job flow procedures, an efficiency study of the keypunch operation, and the design of a multiple console hardware configuration. On the drawing board were a centralized user inquiry "hot line" and a three-day work week for computer operators. 95% to 98% of the reports and output of Operations were being delivered to users on time.

Information Services charged users on a simple full charge out basis for its work. Costs of development of applications and requested maintenance were charged out directly to the user involved. All other costs, such as equipment costs, operating personnel, technical support, general maintenance, etc., were allocated to users on the basis of their usage share of computer time. In practice, an estimated hourly rate was calculated at the beginning of a quarter, with the actual determined at the close of the quarter when exact operating costs were accumulated.

The Reorganization

Early in 1972 the Marshall firm was asked to examine the MIS function of Bay Markets and make recommendations for

any changes. Although some managers in Information Services felt that a more technically oriented firm should be hired, Marshall was selected by top management in part because they represented a combination of consulting experience in MIS and general management. In September the firm submitted its final report, including recommendations for a reorganization. The fees and expenses for the study totaled $94,000.

As background for their recommendations, the consultants noted that Bay Markets was nearing the end of an intensive five years of computer growth that had been painful but had achieved good payoffs from the computer. The task confronting the company now, according to the report, was to continue to achieve some high payoff projects in certain divisions, but also to concentrate on better control of the computer resource and to "clean up" the existing system which had grown so rapidly. It was pointed out that the company continued to spend a high percentage of sales on computer budget compared to the food retail industry, but that these expenditures should fall into line in the next few years as other companies caught up and Bay Markets leveled off. No net increase in outlays for equipment or employees were seen for several years, and the consultants indicated that in some areas there should be reductions in the budget.

The major thrust of the recommendations were that Information Services be reorganized from the existing structure (Exhibit 2) to a new structure (Exhibit 3). The benefits of the reorganization and new policies and procedures to go with it were to be:

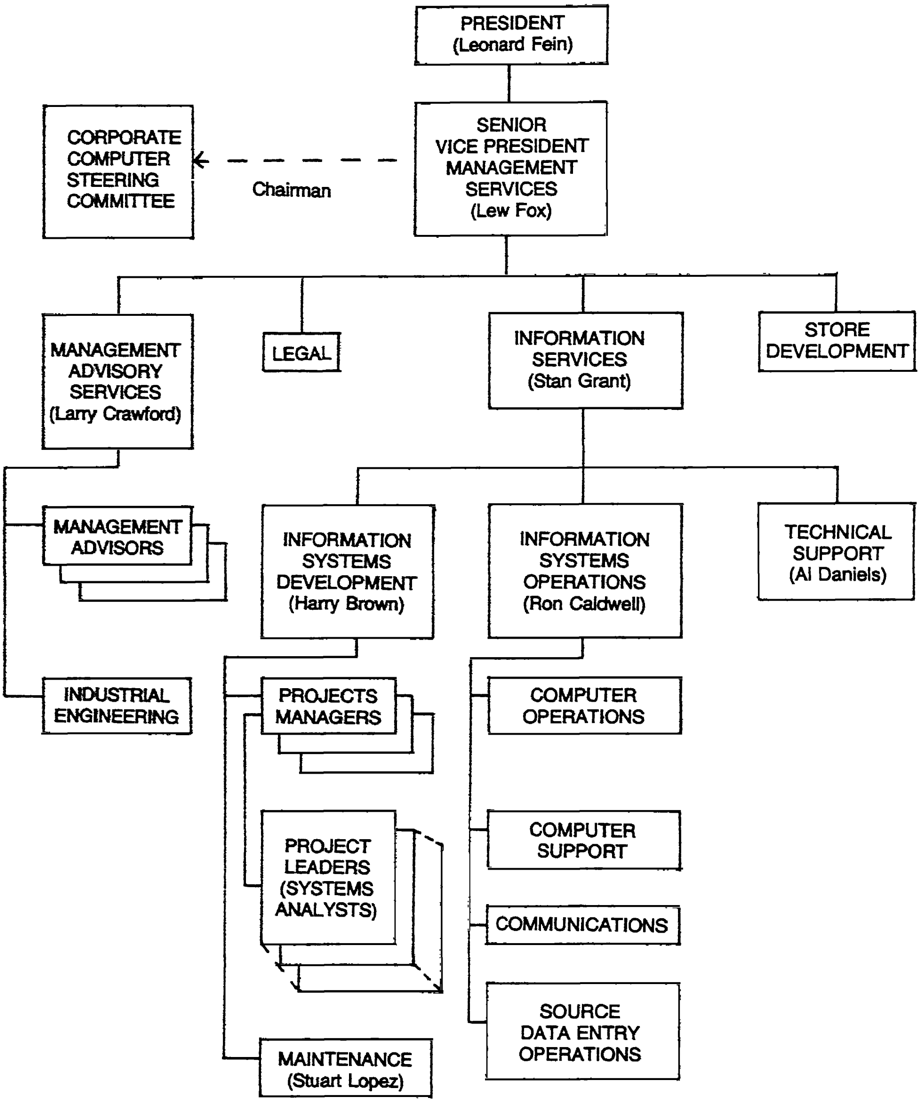
1 An improvement in selecting applications to work on,
2 A reduction in the time and cost of applications development,
3 An integration of the communications and data processing facilities in information services,
4 An upgrading of technological planning and research.

The report recommended that the Senior Vice Prsident, Mr. Lew Fox, be assigned to head the new organization. Fox, a lawyer by training, had been head of the Legal Department and Store Development Department. Fox admitted to being unfamiliar with the technical aspects of MIS. His principal exposure to MIS had been to serve as a member of the corporate steering committee under the existing organization.

Exhibit 3

BAY MARKETS CORPORATION (A)

Organization for Management Services--Late 1972



Stan Grant, as head of Information Services, would report to Fox. Harry Brown would report to Grant and become head of Information Systems Development, a group reduced in size from what had been known as EDP under the old organization. Operations under Caldwell and Technical Support under Daniels would report directly to Grant.

The report established a new group, known as Management Advisory Services, which would report directly to Fox and would consist of systems analysts and business analysts closely tied to specific user divisions and groups. These people were to take on more of the user point of view, initiate projects for the project teams in Information Systems Development to work on, and make it their business to understand the information needs of users to whom they were assigned on an ongoing basis. In his discussions with the consultants and top management, Stan Grant recommended Tom Johnson as head of this new group. However, the post went to Larry Crawford, a man in his thirites who had no previous MIS experience but had proven himself elsewhere in the company. Johnson went on to become a staff assistant to Mr. Fein, the president of Bay Markets.

The report indicated that attention to "maintenance," described as internal improvements of existing applications programs and data processing systems, was a high priority for the future. Nevertheless, little detail was given as to the exact means by which this was to be done. The report described the process of supplying information services in terms of three phases: (1) definition and selection of projects, (2) development and maintenance of systems to fit project requirements and processing of systems, and (3) testing, debugging, and implementing systems for users. It emphasized that the first and last phases should receive the most resources in the near future--that is, the initiation of high cost-beneficial projects from the existing backlog (some 60 projects made up the backlog) and the implementation of projects into user areas.

The report indicated that the new Management Advisors were to be the focal point for ideas of applications, including not only new projects but the upgrading of existing programs and on-going maintenance. Having worked with users closely, MAS advisors were expected to represent user interests more forcefully in the development of new applications and changes in existing ones. On a given project, the MAS advisor was to develop a presentation for consideration by the new steering committee, chaired by Fox. Upon

approval, the project would be turned over to one of the project managers under Brown. In contrast to the existing method of applications development the report described the process as "project management" or the "team approach," in which project leaders would head up a temporary team consisting of the MAS advisor and whatever other user, technical or operations staff members were necessary.

In addition to carrying out projects suggested by the Management Advisors and approved by the steering committee, project managers were described as having the responsibility for keeping Management Advisors up to date on opportunities for making existing and future computer systems more effective and efficient, such as might be done through the integration of data bases.

Specific attention was given to the maintenance function in the reorganization structure by the creation of the "maintenance" group under Stu Lopez in Information Systems Development. It was recommended that ten programmers and analysts man the function.

The report reiterated the existing role of the Technical Support group in keeping abreast of the latest technological advances in hardware and software and recommending changes to the Director of Information Services about improvements that should be made to the existing computer systems.

In addition to restructuring the organization, the report recommended increased formalization of control over the MIS function as a way of ensuring that user projects of the highest benefit to the company were worked on and that the function was run at the lowest possible cost.

The 1973 Marshall report was seen by management at Bay Markets as being a significant step toward increasing the role of users in MIS and orienting the work done in the MIS function more toward user needs. As one manager described it, the aim was "to break the iron ring" of control over applications by Information Services that many felt had prevailed.

The report concluded with a two-page "implementation plan" that gave deadline dates for implementing the reorganization. The recommended reorganization was officially put into effect in November, 1972, right on the schedule suggested by Marshall. Lew Fox called or met individually with all the managers directly affected, and followed this with a three-page memorandum that described the new organization and new responsiblities of the key managers.

The Maintenance Issue in 1973

In February of 1973 Stan Grant called in the Peninsula consultants to examine the effectiveness and efficiency of Operations and its relationship with other departments in Information Services. Grant felt that there was growing pressure to obtain more CPU capacity, and that Caldwell was having an increasingly difficult time meeting the demands of users for on-time reports and output. The consultants interviewed Caldwell, Daniels and Brown, as well as Grant.

As a major problem affecting his job, Caldwell noted that many of the systems running now were very inefficient, resulting in longer run times and operating near CPU capacity at the peak load time. This created a great deal of pressure on him and his subordinates and led to delays in the tight schedule on occasion. To make up for such delays, Caldwell sometimes found it necessary to cut back on the test run time scheduled for Brown and Daniels.

Despite his recognition of the efficiency problem, Caldwell was reluctant to insist on increasing capacity by the purchase of additional computer CPU. He had the strong feeling that the inefficiencies of the existing systems, including software and peripheral IO, were such that it might well be possible to avoid purchasing new CPU. However, he had neither the time nor resources himself to make a study of this. Instead, under the reorganization introduced as a result of the Marshall consulting project in 1972, Caldwell understood he was supposed to submit requests for specific maintenance improvements to Stu Lopez, who headed the maintenance group under Brown in Information Systems Development. At the same time, he recognized that the analysts and programmers working with Lopez might not be the best informed people to study the overall efficiency problem, which Caldwell saw as involving the question of additional CPU, the question of balancing hardware, and the question of operating systems software, as well as application program improvement.

Moreover, Caldwell suspected that his requests to Brown and Lopez were "put at the end of the list" of projects to be worked on. He pointed out that only seven of the 29 people engaged in programming were budgeted for Lopez's maintenance group. This 25% commitment, he observed, compared to an average of 60% to 70% in other companies with a mature, user-oriented MIS function. In addition, he

pointed out that far less than 25% of the budgeted manhours were actually spent on maintenance. Such work was considered "low status" by analysts and programmers, and did not get the pressure it deserved from the users themselves, who were generally more interested in new applications. Maintenance project teams were frequently "cannibalized" to get people to work on high priority applications projects.

When asked why this problem hadn't been discussed with the other managers of the MIS group, Caldwell replied that Grant hadn't called a meeting of Information Services managers in the previous four months. He expressed the opinion that a maintenance group should be assigned to him so that upgrading could take place as he determined it was required.

Taking a long-range view, Caldwell felt that if the immediate pressure could be relieved, so that the operation was not running so close to capacity and was improved in operating efficiency, the longer run problem still required a different solution. That is, he felt that the new Management Advisory Service group, set up as a result of the Marshall recommendations and headed by Crawford, should take on the responsiblity for educating the users to the need for ongoing maintenance and to the advisability of their paying charges for new programs developed for their use.

Caldwell concluded:

> It's at the time of project development for users that we need to get their commitment, verbal and monetary, to an ongoing use of resources for maintenance. They have to understand that maintenance is not something that needs attention because their projects were done wrong, or because a program wears out in some way. It results from the inevitable changes in a program as it is used and modified over the years and also from the changes that occur in computer hardware and software which make old programs inefficient. They don't understand that now...

The consultants next talked to Al Daniels, asking if he felt that substantial savings could be obtained from systems revisions as Caldwell had suggested. Daniels responded that at any given time a major CPU reconfiguration project on any major installation could yield up to 50% additional capacity. He added, however, that he and his group were neither in a position to analyze maintenance proposals, nor did they have the time to devote much

attention to consideration of large scale application maintenance studies.

Harry Brown told the consultants that he totally agreed that maintenance expenditures were inadequate. He said that he had conferred personally with Lew Fox on several occasions about the problem. He explained that because he had formerly been head of Operations he totally sympathized with the frustrations Ron Caldwell had described, but in his present capacity his hands were completely tied. Brown further stated that it was not his job to "grease the squeaky wheel," but rather to evaluate user requests for development projects objectively and to prioritize the funds allocated to his department as he deemed appropriate. To him, computer operations was merely another user competing for a limited development resource and that was how it should continue to be.

Brown felt that the place for the maintenance group was right where Marshall had placed it, in Information Systems Development. By having maintenance people under his jurisdiction, Brown felt the organization gained the flexibility of short-run changes in manpower, in that it was possible to shift people easily to the most pressing and important projects as necessary. He concurred that "maintenance" was a dirty word among systems analysts and programmers, and pointed out that he had recently changed the name of the group under Lopez to "Quality Assurance and Support." He had asked Lopez to be responsible not only for maintenance but also for seeing that new applications and specifications were fully documented and took advantage of efficiencies in the current operating systems. Brown suggested that the budget for maintenance be broken down into two parts, one for "user related" projects and the other for "efficiency" improvements. The efficiency budget would be for projects initiated within Information Services.

In his discussion with the consultants Stan Grant focused on the question of obtaining additional CPU capacity by replacing the 360/50 with a 370/145 versus undertaking a major cleanup of systems, hardware, and applications programs. He felt this change would give additional capacity as well as provide greater reliability and compatibility with the 370/155. Moreover, he said he could arrange the lease agreements so that the switch could be effected with an insignificant increase in equipment expenditures. He felt that it would be a particularly bad time to undertake a major maintenance job.

To support the bad timing argument, Grant said that "the dust hasn't settled" from the Marshall reorganization, and that roles and relationships were still uncertain. As it stood, maintenance was under Brown, user relationships under Crawford, the problems of running inefficient programs fell to Caldwell, and it was Daniels' responsiblity to build in efficiency with new hardware and software. Grant argued that a big new special project would require each of them to give up time from somewhere and to take special efforts to coordinate their work. He added that such a project would have to be paid for by someone. He noted that the charge-out system operated on the principle of users paying directly for as much work as possible, and that while some of the maintenance in a major project could be charged directly to particular users, the biggest costs would have to be overhead. Under the current corporate-wide budget crunch, Grant felt users would come bitching to Lew Fox if their billing rate went up as a result of this.

Grant believed users at Bay Markets didn't see the benefits of maintenance and system efficiency, but simply wanted their reports on time and new applications implemented "yesterday." With a new project the charge for it would go to the user immediately but the benefits in reliability or shorter run time would not be seen for months. Grant noted that a big project would necessitate having to pull some systems analysts off user projects and put them on the maintenance project which would be difficult to explain to a user who was waiting for his project to get done.

In commenting on his responsiblity in this matter, Grant said he saw his job as gathering the necessary facts from each of his subordinates, making an analysis and coming to a recommendation to present to Fox, rather than burdening Fox with technical details.

The Peninsula Report

On a Friday near the end of February the Peninsula consultants made a presentation of their findings to a colloquium of their colleagues and to the Bay Markets' clients. Because of a sudden important meeting at the corporation, only Ron Caldwell and Al Daniels were able to attend from Bay Markets. It was during the discussion,

after hearing about the inefficiencies in the existing systems, that a Peninsula associate heatedly accused Ron Caldwell of being "not worth his salt" in letting the situation go unnoticed by top management.

On returning to his office the following Monday, Ron Caldwell picked up the phone and dialed Lew Fox.

Bay Markets Corporation (B)

Cyrus F. Gibson

On March 23, 1973, Lew Fox asked Stan Grant to remain after a staff meeting of MIS managers in Fox's office.

When they were alone, Fox began by telling Grant that he had lost confidence in him and could no longer feel that he could respect his judgment. He referred specifically to the question of the need for maintenance and the evidence of a lack of coordination among Grant's subordinates.

Fox said he recognized that Grant had many admirable skills, but that after very careful deliberation he had decided to dismiss him from the company.

Fox went on to explain that Grant should feel free to explain the cause of his dismissal as budgetary pressure, but that in fact the other reasons he had mentioned were the important ones.

Bay Markets Corporation (C)

Cyrus F. Gibson

As a result of his conversation with Ron Caldwell after Caldwell's visit to the Peninsula discussion in February, 1973, Lew Fox had called a meeting of MIS managers at Bay Markets Corporation. Present were Fox, Stan Grant, Larry Crawford, Harry Brown, Ron Caldwell and Al Daniels. [For background and organization chart, see "Bay Markets Corporation (A)".]

At the meeting Fox had called for a written report on the issue of CPU capacity, with particular attention to the feasibility of having a single CPU. He asked that all the managers present take part in the study and that "dissents be aired."

It was approximately three weeks later, after discussion of the results of the study, that Fox fired Grant. Grant was relieved of his line responsibilities as Director of Information Services, and of his leadership of a special, confidential project. He was to remain as a member of the team on the special project for two or three months.

This case presents the views of managers in Information Services regarding the single CPU project, the change in management, and the current state of and prospects for the MIS function.

THE SINGLE CPU PROJECT

The feasibility study had undertaken to answer two questions put by Fox: (1) "Do we have latent capacity?", and (2) "What can we do to delay new hardware installation?"

In the study, Caldwell and Daniels, who worked together on hardware and technical considerations, soon came to believe that not only could major additional CPU acquisition be deferred--perhaps for as much as two years--but that in fact the existing 360/50 could be dispensed with. The study revealed that computer channels were badly imbalanced

and flooded with data that wasn't needed to accomplish the jobs being run. It was concluded that effective CPU capacity could be increased by 40% through improved balancing or "trimming" of hardware, upgrading the operating system to MVT to replace MFT, and the redesign and restructuring of applications programs and data bases to take advantage of these changes.

Caldwell and Daniels and the others reported their findings to each other and to Fox. After two weeks of the study, the team submitted a report recommending this reconfiguration and "clean up." This was followed by meetings in which the group discussed the pros and cons. In the meeting on March 23, Fox approved the project.

The 40% savings in capacity were expected to result from two different efforts. Thirty percent was expected from the hardware "trimmings" or "tuning" and the new operating system, with the responsibility for these falling to Al Daniels. Daniels would also be responsible for retraining operations personnel in the modified systems. The other 10% was to result from work by Harry Brown's Information Systems group, which was to rework applications programs. In addition, Brown and Crawford were to communicate with users on efforts to ease the time pressure on Operations resulting from the tight daily schedule for delivery of reports and other output. It was calculated that these efforts, which constituted a five-month first phase of the project, would cost between $150,000 and $300,000, largely manhours of existing MIS personnel, and result in savings of $400,000 a year. Some 75% of these savings would result from elimination of the lease cost of the 360/50, and the remainder from the reduction in staff of eight or nine operators.

The casewriter was present at a meeting held on March 29th to discuss the single CPU project. The consensus seemed to be that the project made sense.

Stan Grant expressed his view that the users might object to the charge-out rate when it reflected the high overhead from the project.

Harry Brown pointed out that it might not have been possible to initiate such a project until the CPU capacity problem had arisen. He indicated that the size and scope of the project made it interesting and attractive to programmers who otherwise would prefer applications work. He believed that with the investment in the project and some ongoing allocations to maintenance after the project

was completed the problem of future maintenance would be solved.

Ron Caldwell made the point that some steps needed to be taken to insure that maintenance was built into future applications, after the project had cleaned up the current systems. At this point the following exchange took place:

Brown: With this project we are really nearly there on maintenance....

Caldwell: 'Nearly there?' How can you say we are 'nearly there'? We aren't even into the project yet.

Brown: I mean we are investing a lot on this project, and once it's done we shouldn't have much trouble managing the maintenance thereafter....

Caldwell: Yeah, but let's make sure we get to that point. What I'm saying is as an ongoing problem we haven't even been spending the 25% we budget for maintenance in your area, and some companies spend up to 90%.

Brown: Well, I think that is unrealistic. We should spend maybe 35%, but not 65% or 70%.

Caldwell: Like I said, we have to get the users educated to what maintenance is and why money spent on it is justifiable....'

"We now have the 1973 view of the EDP management function," said Ron Caldwell after the meeting as he described to the casewriter the project and the way in which Fox had brought it about. As Caldwell put it, "the axe is over Daniels' head" for primary responsibility in the project, but "the really difficult part" would be the job falling to Crawford and Brown to make changes in user programs and to convince users of the need for less immediate output delivery. His own role would be monitoring the resource uses by Brown and Daniels as the project proceeded, by reviewing their reports and "making sure we're spending the manhours we said we would" on the project.

For the long run, Caldwell said there was still the need for clarification of how maintenance problems would be handled on an ongoing basis. He suggested that one method might be to build in a maintenance charge at the beginning of a project. He added that he did not want responsibility for maintenance to come under his jurisdiction.

Caldwell closed by saying the project was 'the first time we've had coordination among us.' He added:

There are natural conflicts among us, sure. Just the nature of our different jobs is enough to cause that. This project will put that organizational friction to the test. What's important is that we not try to do away with argument, but take these natural conflicts as a way of doing business and getting a better product.

LEW FOX'S VIEWS (MARCH 29)

Before leaving on March 29th the casewriter talked to Lew Fox about his job and his approach to managing Information Services.

Casewriter: Would you tell me how you came to be in your current job?

Fox: I got a basic education in what was going on in the old Information Services when I was on the steering committee for corporate projects. Then when Marshall came in three years ago I worked a little with them. When they came in last year to work on reorganization they interviewed me and recommended that as the Senior Vice President I become head of Management Services. It was by a process of elimination: the President, the VP of distribution and services, and the corporate controller were all considered, but were too busy or presented a problem in terms of equitable distribution of services to users. So they offered it to me after some consideration of alternatives. I didn't resist.

I should make it clear that I am not experienced or knowledgeable about MIS. Keep in mind that six months ago I was in charge of the legal department and the real estate department, plus a variety of ad hoc corporate responsibilities. I only knew enough about computers to sit in on a steering committee and that wasn't much.

I have been mostly educating myself. I spent four days at an IBM school, which was obliquely useful, and I plan to go to a few other computer management courses.

I sensed I would enjoy a broader involvement in line work. It has really proven to be a challenge and a thrill as I take on learning what is for me a whole new set of skills. At the same time, I remain as involved as ever in high level decisions and as a counsellor to the President.

Casewriter: Would you describe the approach you are taking to manage Information Services?

Fox: Instead of talking abstractly, let me be concrete, and go back a bit. After a staff meeting last week I asked Stan Grant to stay over. I told him he was fired.

I immediately called in Crawford, Brown, Caldwell and Daniels and told them I had fired Grant. I knew the word would get around quickly, and I wanted to be the first to tell them rather than have them learn it from the rumor mill. On top of that, I wanted to make it clear that I did not intend to replace Grant, but that the three of them who had reported to him would now report directly to me. I wanted to let them know the slot had been eliminated, and that they shouldn't think I was examining them to see which one would fill it.

I gave them an 'LBJ' speech. I said, 'I need yo hep!' I said I had a technical knowledge gap, that I would depend on them to keep me informed and that I would expect them to be able to translate what they knew into terms I could understand.

It became clear to me in that meeting that previously they had been under a lot of tension and had not been working together or meeting together. A lot didn't get done. For example, Caldwell might lose an hour of run time. Instead of getting together with Brown and Daniels to see who could best afford to give up the test time scheduled for him, the decision got made arbitrarily, so somebody was left mad. Brown, it turned out, had been particularly frustrated. At one time or another each must have thought the other was a fool.

I told them they would have to learn to settle their day-to-day problems without appealing to a higher court. I didn't want to be bothered with their daily problems. They would have to become a team for joint decision-making. In addition, I told them we were starting regular Friday meetings where we would reveal our plans to each other and hash out any problems that arose from planning and schedules. For big decisions we will have five people who will help ask each other questions. For me, this is particularly important in Daniels' and Caldwell's areas--the highly technical areas. I will be depending on Crawford and Brown to help me ask the right questions. Although they are all at the same level now, they are not 'equal'. They have different skills and different expertise.

The organizational structure is not cast in stone. I'm

still trying to settle the question of what the four should meet on and what should be pushed up to me. It's going to take a while to settle that...

So, my approach now is to run without a Director of Information Services, and to run with as much sovereignty for subordinates and as much coordination as possible.

Casewriter: The CPU reconfiguration question led to a man being fired and a big project being undertaken. What I wonder about is how do you intend to prevent this happening again? Do you have any assurances that it won't?

Fox: First, the reconfiguration question was just the most recent piece of data that led me to the decision to fire Grant. There are two devices to insure that it won't happen again. One is that these four men will be sharing information, exchanging information and keeping informed on what each other is doing...

Casewriter: Do you have some new reports?

Fox: No, I'm referring to the fact that each one will agree in our planning meetings about what the other will do, as for example on the allocation of manhours to the reconfiguration project, and the monthly and quarterly actuals report will let everybody know if the plan was followed.

The second thing is the informal communications among the four.

VIEWS OF THE MANAGERS

Two weeks later the casewriter returned to discuss with each of the managers involved their separate views.

Ron Caldwell

As the casewriter waited in Caldwell's office he noticed the desk was cluttered, a sharp contrast to its cleared condition on the previous visit.

When Caldwell entered he apologized for being late.

Caldwell: One of the computers is down and I may have to get up off and on to see how things are coming. We will miss about thirteen hours of run time by the time we get it up again, so several reports are going to be late today. There are 70 people out there waiting around to carry reports. The most important is grocery distribution. If it looks like we aren't going to get it fixed

in a few hours we can go to the vaults and get our 'modulars. Modulars are output based on an average day of orders which we keep in the vault for an emergency.

Casewriter: So by using the modulars you can approximate the orders the stores place. Will it be close enough to what they wanted?

Caldwell: Well, they might lose some sales if we go to modulars and there are items on sale that have an abnormally high demand. But we should get it fixed soon. As for the people waiting around, they get about $5 an hour on the users' payroll, but they have to be paid whether they're waiting or working. They could be put to some use, but so far the users don't seem to want to have them do anything but wait. I guess that's their problem.

Casewriter: Doesn't going to a single CPU make you more vulnerable to system breakdowns than having two?

Caldwell: We don't really have a full backup system with two computers now. Also, being down for thirteen hours is highly unusual. We had trouble because IBM's diagnostic system didn't work. We took our two most critical runs to two different computers at other companies nearby, and damned if both of them didn't break down right after we got there! This kind of coincidence is very unusual.

What we need to do is give ourselves a buffer time as a normal thing. We've got to get the users to accept the idea that they don't need their reports fifteen minutes after they've been run. The user only sees his need for a report. Somehow we have failed to sell him on the idea that 100% reliability may cost more than it's worth to the corporation as a whole. The marginal cost of getting 100% reliability over getting 95% may be so great that it just isn't worth it. We've got better things to do with our money. But they don't see that. Nobody on the user side is taking a systems view of the thing, a corporate view.

At this point in the conversation Caldwell answered the telephone.

Caldwell: Yeah, Paul, I know your output's late. We told you last night it was going to be late...No, we can't. They've broken down, too....I think it will be about four o'clock this afternoon. No, I can't 'guarantee' that... Just as soon as we can...Well, there's just nothing I can do about it, as I've told you...That's up to you. (Hangs up.)

There's an example of what I was saying. Accounts Payable in one of the divisions wants their checks. Their treasurer is putting pressure on them, telling them if they don't get checks out to some of their vendors this afternoon the vendors have threatened to cut off their credit...

Casewriter: Have the users been told about the single CPU project? Are they aware of how much more they will have to pay on their charge-out rate as a result of manpower being spent on work that isn't directly chargeable?

Caldwell: They are beginning to hear via the grapevine that we are investing in the project. I don't know why we haven't told them. Maybe we're lazy. It goes back to what I was saying about the need to educate them, though. What we really need to do is change the people in user areas, or change their thinking, so that they think like businessmen, taking all the costs into account, and not like merchandisers, just wanting to get stuff on the shelves.

It's a matter of corporate philosophy. So far all the corporation wants from EDP is that it be managed on a day-to-day basis, on a problem-by-problem basis. They have never set a direction for EDP, nor looked at our function as part of the whole. They don't seem to know how to use EDP. For example, we have no policy that I know of on developing an automated warehouse or a major point of sale system. What we do have is a clear guideline to spend as few dollars as possible during the current profit squeeze.

Casewriter: You are now reporting to the Senior Vice President, and you are two levels down from the President. Couldn't you take the initiative toward this kind of corporate approach to EDP?

Caldwell: You have to keep in mind that nothing below me has changed. Just six months ago I reported to Brown, who reported to Grant, who was two levels down. I could pay attention to directing people and handling problems as they came up. Until recently my thinking was oriented to helping Operations, not thinking about what services I should provide but how I could provide what we have more efficiently. Now I am in a position where I have responsibility for that broader view, and it is more a matter of negotiating with others to get those things done, rather than merely giving orders. But if my responsiblities are going to be increased it means I have to get my people to take on more responsiblity for running things. That takes time. They're good, but they have to learn to pick it up.

Not only that, but take a look at this. (Picks up a memo.) I just got this new schedule from personnel of salary rates for the different grades. It's completely contrary to what Personnel had agreed to: they haven't added enough to the grades of my people to fit with the added responsibility I'm expecting them to take. I'm not going to accept this! I'll take this one all the way to the top if I have to!

Casewriter: You mentioned that you now have more responsibility and opportunity to negotiate. Is that in any way due to differences between the way Grant manages and the way Fox manages?

Caldwell: Previously, the intermediate levels of the organization filtered information too much. What top management heard was what the people just below them wanted to be heard. It was impossible for them to get the full information on an issue. When Grant recommended getting the 370/145 it wasn't in the form of alternatives. By contrast, when we looked into the single CPU project, Fox gave us the evaluation task in the form of questions. Our approach is a contingent one now. If it turns out in June that we need an additional CPU after all, we can do it. We are not committed to a black and white end result of no additional CPU. If we did that we would be taking the no-alternatives approach that Grant took.

Casewriter: Isn't it unusual for a computer operations department to be reporting at so high a level? What are the implications?

Caldwell: For one thing, Fox needs a counterbalance to evaluate the situation in Technical Support and Operations. He ought to have a staff man to provide him with an appraisal of our views on the technical matters. What's happening right now is that the four of us (Caldwell, Daniels, Brown and Crawford) provide a kind of balance within our level when we meet. We challenge each other. For example, Brown is very conservative on what I should have in Operations. He would have it pared down to the bone. Daniels would like me to have all kinds of computing power. But it would be very easy for Fox to be snowed if we ever banded together.

Casewriter: I understand the idea behind the present structure, with four people reporting to Fox, is that there should be a lot of group discussion and decision-making. Is that workable?

Caldwell: It can work, but several things have got to

happen. First, we have got to build up the people under us to take more of the load. Second, we have to better define what we take up as a group and what we leave to each of us to handle. For example, we ought to leave day-to-day problems out of group meetings and talk about things like company-wide technology, like divisions wanting to build their own EDP capability.

Three is a potential problem of conflict among the four of us, but it doesn't exist as a problem right now. We have worked together before and we know what our roles and separate jurisdictions are on a day-to-day operating basis. We mediated our own problems before, and we have done so since the changes. I think Fox determined that we were a good mix before he decided to try this approach.

Casewriter: You mentioned that Fox should have a staff person to counterbalance the technical people reporting to him. Wouldn't another approach be to fill the slot Grant was in?

Caldwell: I think filling that slot is a dead issue for about three years. We just don't need anybody there. We have a fixed equipment budget through January of 1975, so there will not be that much change in the nature of our resources. Also we are in a budget squeeze and there's $45,000 a year in savings. In a couple of years we can face decisions on where we go for the future, such as automated warehouse, point-of-sale systems, or whatever looks attractive at that time to get us out of the high labor cost bind we will be in. But at that time we can go out and hire an executive to fill the slot who has experience in whatever we're interested in. This means we are deciding not to be first with these systems--or rather we are recognizing the profit crunch as telling us we don't want to be first. Right now we have to retrench.

In three years or so I wouldn't be surprised to see Fox become the president of this company. That's when they will need a new vice president for Information Services. At that point it may make sense for a Technical Support man to be a vice president, too. I doubt very seriously if I will be here...

I think our organization is a little unusual right now, but I'm not sure we have seen the last of the changes just yet.

Al Daniels

Casewriter: What kinds of problems are you facing in the new organization and with the responsibilities of the single CPU project?

Daniels: A big problem I face is that I am understaffed. I am supposed to have nine people in my group, but I am down to four now. Stu Lopez from Brown's group is the project manager on the single CPU project, and because I am short of people I find myself in on the meetings. Right now I'm spending a lot of time interviewing people to fill my slots. I've lost three people in the last few months.

Casewriter: Any particular reason?

Daniels: Morale. Oh, in one case a guy had a big dollar increase offered by another company, and there have been some other reasons, but morale is pretty bad since the reorganization. I would estimate 90% of people below my level in Information Services had their resumes out after the reorganization last November.

Nobody knew Lew Fox. I finally asked him to talk to my people last week--they had a kind of 'encounter' session. I understand they asked him what the next change was going to be. They don't think things have settled down yet.

Caldwell and Brown don't agree with me that there are morale problems below us.

The reorganization was expected back in November. Everybody knew a change was coming, but when it came it was very sudden and with no details. Fox told me over the phone what the new organization would look like, and said, 'We'll talk about it.' We never have. Then there was a three page memo saying, 'We are reorganizing, effective immediately' and describing the changes and new job descriptions. That was it. I can understand the emphasis Lew has in working out the new organization: first he spent time thinking about Brown's group, ISD, then he will get to Caldwell's. Meanwhile, I am having to implement changes in what we do in Technical Support on my own. It's disconcerting, sometimes. For example, I'm supposed to take care of educating Information Services, but I have no idea how important this is supposed to be.

Casewriter: What do you see as the differences in how Information Services is managed since Grant was dismissed?

Daniels: Grant worked one-on-one with his managers, or maybe would talk to two of us at a time on a particular problem where we had some expertise. He was more comfort-

able accumulating data himself. I can remember seeing him in the office of my systems programmers, and I wouldn't know what in hell he was there for. When he knew what he wanted he would advise or clear it with his boss. We never had a staff meeting. He wanted to make the decisions himself, then pass up the answer. Then, you have to remember, Grant was head of all this at a time when we were still on the cutting edge of applications. Our primary purpose was to get data out to the users fast. Now we run into a decline in profits in the corporation. The attitude becomes, 'the corporation can exist on the kind of information systems it now has, so let's restrict data processing expenditures and go after savings in hardware.' So, we end up with the single CPU, which will save us $400,000 over a year and a half by doing some investment now.

It's too early to tell how Fox will manage. He's trying to be participative, getting the four of us together to pass information up to him and discuss things among ourselves. The four meet every Thursday, then again on Friday with Lew. He wasn't getting data from Grant. Grant was reluctant to give up the reins after the reorganization.

Lew is the kind of guy who wants to see all sides of an issue. He sees himself as a generalist, somebody who understands the users' point of view. And he comes right out and admits that he doesn't have EDP experience and doesn't know what's going to happen technically.

Casewriter: How is the participative approach working?

Daniels: As I said, it's really too early to tell. With Fox as head and the four of us reporting to him there isn't one guy alone who can give him a technical decision. If you try to do that you have to battle the other three. So there has to be a lot of uncertainty, and a problem of backbiting that could crop up.

For a while after the reorganization I think Brown hated like hell giving up Technical Support and Operations. Caldwell and I found it necessary to band together to break down the barriers that were created by Harry. That seems to be better now. I worked with Caldwell on the study for the single CPU project, and we seem to agree more often than not in staff meetings. But I have learned to watch myself with Caldwell. He's a guy who is in a hurry, and I wonder sometimes if he isn't likely to use people to get there...

I'm taking an MBA course in night school, and the

other night we were talking about different styles of management. The four of us really have different styles, ranging from authoritarian to participative. I would put Caldwell at the authoritarian end, next Brown, then Crawford, and me at the participative end. In a way, I guess each of us has a style that makes sense when you consider what we have to do with our groups...

Casewriter: So you think the new organization will work in time?

Daniels: What I'm wondering is how long the present structure will last. Fox seems to have taken over the management of the thing as an interim guy, who wants to get the user orientation into EDP. I think he is managing by committee right now waiting for the cream to rise, waiting for someone to show he can manage the other three. I think he wants to choose a filter, a buffer to head up the departments and report to him.

Larry Crawford

Casewriter: What kinds of problems are you having to deal with in the new job that was created by the Marshall reorganization?

Crawford: I find that it is going to take me twice as long as the six months I first estimated just to establish my role with users and to stop and redirect existing projects that have been mismanaged. In MAS we have found all kinds of problems in applications projects that should never have been started the way they were.

The users need to be convinced to take responsibility, to stand up for their ideas and present their case to Information Services. That's the job I'm trying to get them to do. I have six people working for me. Four of them came out of the old SPD group under Tom Johnson, who reported to Stan Grant. These guys were used to resisting the users, and didn't like working with them to get at a problem.

When I took over Management Advisory Services there were something like 80 requests for maintenance projects that had been submitted by users to Information Services. Brown saw them all as low priority. When a user saw he couldn't get his request filled, it led to some interesting game playing. For one thing, a user would ask for a new application when what he was really after was just a minor change in an existing one. Or, he would put in multiple re-

quests, many of which he didn't care about at all, as part of his negotiating strategy. Some users hired their own systems analysts.

Casewriter: What has been your experience in working with the other three managers who report with you to Fox now?

Crawford: Well, my contact has been almost entirely with Brown, and I'm sure he sees me as on his back all the time. I'm having a very difficult time getting response to my requests for attention to projects. I find myself calling meetings with Brown and some of our people, and we'll get together and talk and seem to agree on something, then weeks will go by and nothing will happen. Or I will send Brown a memo about the need to set cost estimates for an application project--that's a very important thing we are supposed to do together. Time passes and I won't hear anything.

It's gotten to the point where I hesitate to call meetings, especially if they involve all three of the others, for fear I will seem presumptive.

Casewriter: Someone suggested that the team approach that Fox has instituted may be a way for him to observe who should be promoted to be in charge of Information Services under him.

Crawford: I don't know if that is true. I believe Fox has tried to make it clear that Grant's slot will not be filled.

But I think about the situation if people do believe that. If the present structure doesn't work, Fox is going to have to do something different. If somebody thinks he has a shot at an open slot, it might very well be in his interest to see the current setup not work! It blows the mind!

I think Brown is in a funny position. Fox had depended on him to be his rudder in this team. Fox is the second most powerful man in this company, and he has accelerated the pace of the single CPU project, but he doesn't know the technical side. Since he fired Grant he has depended on Brown as the most experienced guy with technical knowledge. And he has gambled on Caldwell and Daniels. I think he learned from their work on the CPU project study that they knew the technical side of their jobs. Now he wants to see if they and the rest of us can work as a team. He's depending on Brown to help him understand the technical side, since he could be easily snowed in that area. He's also counting on Brown to adapt to working

with the rest of us as a team. That means he is depending on none of us trying to be a superstar in front of the others, and also for none of us to be dragging our feet. I got called down by Fox last week when I started talking to Brown in the staff meeting about why we hadn't made any progress together. Fox said I was being 'too harsh.'

Casewriter: How do you think the team might work better together?

Crawford: I don't really know. Maybe we need an 'OD' session or something. The other day Brown called me and suggested we talk about why we weren't communicating very well. We got together and talked about the different way we approached things. I thought we really began to understand each other for the first time, but we haven't followed it up...

Harry Brown

As the casewriter began to interview Brown in his office, he explained that the case was intended to provide information related to the organizational and interpersonal aspects of recent events in Information Services.

Brown: I will be glad to describe how we do things, but I don't delve in the political. My approach is to treat the job as a job and do the best I can. I don't really pay attention to the political side.

Brown went on to explain the history of the MIS function at Bay Markets, the way in which the department operated before the reorganization, and the way it was designed to operate afterwards. (See Bay Markets Corporation (A) for a description of these points.) In talking about the single CPU project, Brown continued:

> I look at the single CPU project as a chance for us to regroup ourselves after five years of intensive growth effort in applications. Stu Lopez is the manager from my area, ISD, on the project. He has two systems analysts and seven programmers on it. Al Daniels has practically his whole staff on it. Caldwell will be retraining his operators when the time comes. Crawford will have the responsibility to reschedule and loosen up delivery times to help Operations get some breathing space in their schedule. So we are all involved in the project.

After the five months of the first phase of the project is up, we will be continuing the effort. Lopez's group, which we are calling Quality Assurance and Support, will have three programmers and an analyst full time. One of their duties will be to continue to make sure the system is running efficiently, and also to take care of user requests for applications support.

Casewriter: What will be needed for the team approach, with the four of you reporting to Fox, to work as a way of running Information Services?

Brown: Quite simply, for it to work we have to work as a team. It's a real democracy now, with everyone equal. We each have a responsibility to closely coordinate with the others. We used to have a 'siphoning up' to the top, but no longer.

It will take time to work out. We have got to be sensitive to establishing our new relationships. There is a need for mutual confidence, trust and inputs from each other into our own areas. Al and Ronnie have a lot of new responsibilities they haven't had before. Crawford is a new man to us, with new people under him, so it will take time for him to adjust and develop working relationships with the rest of us. It will take time.

Casewriter: You have more people reporting to you than any of the other three. Has there been any morale problem as a result of all the changes?

Brown: No, no...

Sometimes I wonder what I would be thinking if I were in the shoes of my two managers, Lopez and Mortenson. They are in their late thirties and have been with the company 6 or 8 years. They have worked for me a long time, and I can tell you they are making very, very important contributions to this company. (Pauses.)

Casewriter: Do you mean there may be some problem for them about the fact that Daniels and Caldwell have been moved up relative to them?

Brown: Oh, no. There's no 'problem' at all. Don't misunderstand me, these two are very loyal to the company. They haven't said anything to me that would make me think they weren't happy. I just wonder what's going on in their minds, sometimes. I don't know if Daniels and Caldwell have had a pay raise since the reorganization, but I know these two guys are about where they were before...

You asked me before what it would take for the new

organization to work. I guess what it will take is for the four people under Fox to be able to work together well. That's really what it boils down to.

Casewriter: Do you think--based on your knowledge of MIS organizations--that this one is a little unusual now?

Brown: In what way do you mean?

Casewriter: The fact that Operations, for instance, is reporting to the Senior Vice President.

Brown: Oh, I don't know. Is that strange? Do you think so? We've done a lot of innovative things in MIS at Bay Markets. Maybe by having Operations and Technical Support report alongside Systems Development to a Senior Vice President we are introducing in innovation for others to follow in organizing MIS.

Project Paradise

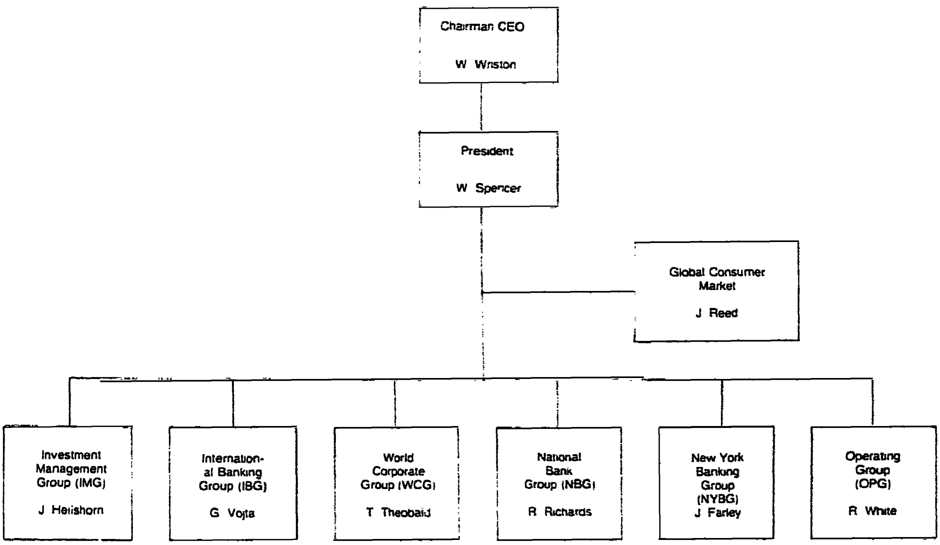
Henry W. Lane
Cyrus F. Gibson

In March, 1975, Robert B. White, Executive Vice President of First National City Corporation and head of the Operating Group (OPG) of Citibank, was concerned about the implementation of "Project Paradise," an ambitious reorganization of OPG which White had initiated in 1974. The project involved splitting up and rearranging the operations and services performed by the Group so that the operations serving customers of each of the different "banking groups" of Citibank were structured together.

Until the introduction of Project Paradise in 1974 operations had been organized according to the similarity of transactions, employee skills or machines required to do the processing. For example, under the old organization all corporate cash management operations were together. As a result of Paradise that part of cash management operations which served customers of the World Corporate Group would be put together with other services for customers of that group, the part which served domestic customers through the National Banking Group would be with other services for those customers, and so on. Exhibit 1 gives the overall group structure of Citibank in 1975.

From Bob White's point of view, Project Paradise represented a continuation of his recent efforts to more closely integrate operations services with the various banking groups. Such an effort would reduce problems of communication and the "cultural gap" that had existed for years between the specialists in OPG and their counterparts in the other groups. Moreover, the concept of breaking down operations into relatively small customer-oriented pieces was consistent with earlier changes within OPG, changes intended to make the operating group more efficient and controllable. Looking back over his five years in OPG, White knew his organization had come a long way toward becoming an efficient, well managed part of the Bank. Project Paradise was intended to make the operations functions fully

Exhibit 1
PROJECT PARADISE
Citibank Group Organization 1975



The individuals named here plus three other top officers constituted the Policy Committee. Its functions were described in the Citicorp 1974 Annual Report as follows:

> The Policy Committee meets weekly to provide a forum for a discussion of broad policy matters which may be institutional or on a group basis. Decisions affecting more than one group or having institutional policy implications are discussed so varying points of view can be evaluated before a collective decision is made.

effective in the organization as a whole, while at least maintaining the gains of efficiency that had been achieved internally.

White's particular concern at this time was that a crucial deadline was likely to be missed in the transfer of jurisdiction of some services in establishing the "International Banking Group (IBG). Missing the deadline would represent a "fail" to White and to the managers involved, since OPG prided itself on meeting deadlines. Moreover, White knew that if this deadline were missed a number of other schedule deadlines would also be missed. This would be particularly painful in the case of IBG Services because its establishment had been carefully planned and arranged between White and his counterpart in the IBG, George Vojta. These particular plans included the transfer of some IBG personnel, the service assistants, into the new IBG Services Organization within OPG as a step toward consolidation of the functions of customer contact and service performance.

Finally, a schedule fail here could also have other effects. White and his group-level staff officers had worked hard to introduce a control system and management by objectives program which would hold line managers accountable for operations under their jurisdiction. The system had evolved out of a "management model" which they had elaborated. The model specified five "results" variables: cost, quality, timeliness, employee attitude and customer relations. Specific, mostly quantitative measures for each of these results had been developed for each organizational unit or service "channel" in OPG. At the beginning of the year a plan was established which set quantified goals for some or all of a unit's results. These goals became task targets in the MBO program for the line managers, targets which had to be met in order for them to qualify for year-end bonuses.

The 1975 plan had been drawn up with aggregate goals set but as yet these had not been allocated by channel. However, slips in the schedule like the current one delayed the reorganization and therefore delayed the assignment of tasks to the managers who would be responsible for them at the end of the year. Thus, for example, a line manager might know that this operation under his control in March would not be his in June. When this was combined with the fact that much of his time was consumed in splitting out the operation and conducting the change, there was little opportunity or incentive for him to concentrate on the task targets for the

year end. White could foresee missing a number of budget targets as a result of this complication in missing schedule deadlines in Project Paradise.

White felt it was important that he decide how to approach this and any subsequent potential slips. One approach involved three variables, each leading to a basic course of action. He could let the schedule slip and be reset, explaining the situation to Vojta in IBG and asking him to readjust his plans accordingly. Second, he could permit expenditures over the budget while insisting that schedules be met. This might entail, for example, permitting additional manpower to be brought in and possibly softening the 1975 plan to reflect less stringent cost targets. Finally, he could "tops-down" the problem by insisting that the schedule and the budget be met, leaving it to the line managers involved to work out how they did it. He knew that this would require considerable further personal effort from his line managers, most of whom were already working ten and twelve hour days. White knew well that this kind of pressure increased the risk of an operational "blowup."

BACKGROUND ON OPG CHANGES

The "Cultural Gap," 1964-1970

Project Paradise represented the latest phase in a long history of change both between OPG and the rest of Citibank and within OPG itself.

Before 1964 there was no centralized operating group in Citibank. Bank office services were performed by employees working closely with those in contact with customers. For example, it was common for an operations officer to accompany a lending officer in a visit to an important corporate account. While the lending officer negotiated loan terms the operations officer would talk to accountants and others in the company responsible for handling transactions. Training for almost every officer included some experience in the department's operations function. As one officer put it, "In those days there wasn't any distinction between operations and banking. We all thought of ourselves as bankers."

By 1964 the volume of paperwork for most transactions and services had grown to the point where further specialization and efficiency were clearly necessary. The number of clerks and officers handling operations and services grew in proportion to volume and grew faster than those handling

the credit side of the business. Specialization of people had begun, and what was subsequently described as a "cultural crack" was created. In 1964 this was recognized by the creation of the operating group as a centralized entity. Communications and relations between OPG and customers and users remained good, however, in part because OPG was still physically located with the rest of the bank in the uptown Citicorp building at 399 Park Avenue.

In 1968, OPG moved to its own building downtown at 111 Wall Street, where the latest in computers and processing technology was installed. As top OPG managers saw it in 1975, this move led to a further widening of the cultural gap. OPG employed more clerks and hourly employees of relatively low skill than the rest of the bank, and people there began to be seen as lower status. It was widely recognized that career opportunities were more promising through the credit side. Differences in opportunity were even reflected in the colleges from which potential officers came: OPG typically got its management trainees from Fordham, St. John's or NYU, while the banking groups attracted the Ivy League graduates.

In the late sixties OPG employed some 8,300 people. Management was seen as very "people-oriented" with emphasis on satisfied workers and officers who liked their work and their superiors. Although a budgeting and control system existed, officers were not held rigidly accountable for results. Within OPG job security was emphasized. Many middle-level officers were quite explicitly oriented toward job security and providing personalized service to customers and old friends in other parts of the bank. Such an atmosphere, OPG managers had felt, was important to provide responsive service and maintain relatively stable ranks of middle-level officers. OPG officers responded personally to service requests from account officers in the banking groups, regardless of what else they were doing at the time. Higher positions were typically filled from within OPG itself, with seniority and experience given heavy weight in promotion decisions.

About this time the top management of Citicorp became concerned over the need for controlling costs in operations. It was realized that the traditional approach to dealing with increases in paperwork, which was to add clerical employees in proportion to increases in volume, would no longer suffice. The volume of transactions being processed was rising at 5% to 10% a year, while operating group expenses were rising at a rate of 18% per year. William Spencer, seen by many as the next Citicorp president, was

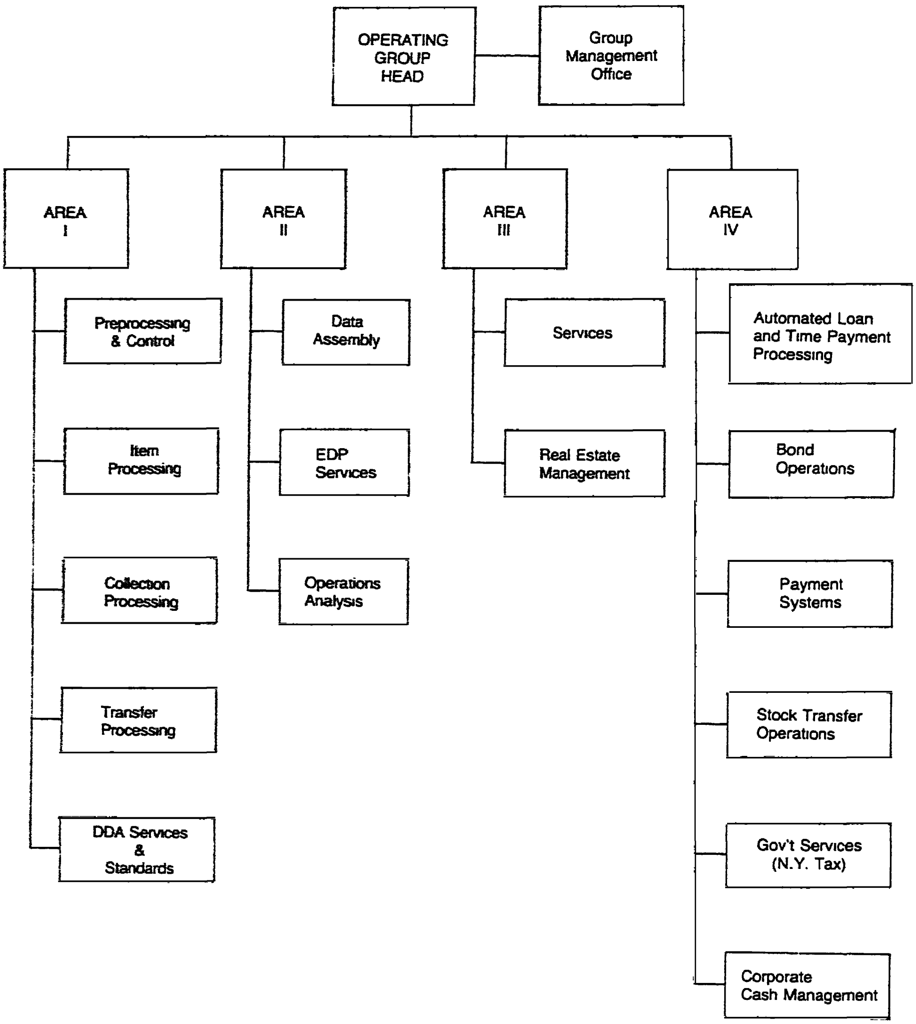
brought from another group and made head of OPG. This was widely recognized as an indication of the importance being given to the operations function.

When Spencer became president in 1970 he was succeeded by John Reed. Like Spencer, Reed had come into OPG management from another part of the Bank. Thirty years old in 1969, he became the youngest Senior Vice President and subsequently the youngest Executive Vice President in Citicorp history. Reed recruited Robert White from his job as director of financial planning in the engineering division of the Ford Motor Company, making him a member of his group staff. This small staff, known as the Group Management Office (GMO), included officers responsible for overall personnel policy, development of new control systems, gathering information for periodic performance review meetings with line managers, design and planning of organizational changes, and the like. Offices of the GMO and the OPG head were in the Park Avenue headquarters of Citicorp.

In 1969 Reed reorganized OPG along functional lines, grouping together the processing of transactions which required similar machine technology and similar clerical skills. Even prior to changes in organization structure, the management of OPG had kept abreast of the latest in computerization and technology for paper processing as it had become available. OPG expenditures for machines as opposed to salaries were in line with or slightly higher than the banking industry as a whole.

The 1969 reorganization resulted in five Areas reporting to Reed. It was basically the same organization in terms of assigned functions to Areas which White inherited when he became head of OPG in early 1974. (See Exhibit 2.) Area I handled the high-volume, low-dollar value per transaction processing, including particularly the check processing or Demand Deposit Accounting line. Area II handled systems analysis and systems development services for other Areas and ran an extensive data processing and time-sharing system for the Bank and some outside customers. Area III was distinct from the other three, with responsibility for maintaining buildings and providing general services. It had little contact with the other Areas. Area IV processed the low-volume, high-dollar value per transaction items such as stock transfer, corporate bond transfer, and corporate cash management, and domestic and international funds transfers. It also provided services to the City of New York in processing city income tax returns. In addition to these, Reed was

Exhibit 2
PROJECT PARADISE
Basic OPG Organization--1970-74



responsible for the somewhat independent research and development unit known as Transaction Technology Incorporated (TTI), a subsidiary which had been purchased to develop new hardware and software technologies in electronic funds transfer both for a national network among financial institutions and for retail and commercial customers to provide point-of-sale use of credit cards. Like Area III, TTI had relatively little interaction with Areas I, II and IV in 1969.

Despite the reorganization and up-to-date technologies employed, however, Reed became increasingly concerned in 1969 and 1970 as OPG costs continued to rise and as complaints from customers and other groups in the bank over service quality appeared to grow with the increase in volume. Moreover, the pressures to hold the line on costs and improve quality of services were such that Reed concluded it unlikely that a major technological breakthrough could be accomplished in time to be the solution to the problem. As he put it, the "great mother of a software system" that would automate their processing and eliminate the principal source of increase in expenses, namely payroll, probably just wasn't going to come in time.

A Wider Gap, 1970-1972

The path Reed chose to deal with the continuing problem of costs was to give line responsibility to a "new breed" of young managers like Bob White. These people and a handful of their own recruits were not thoroughly familiar with OPG processes. Unlike their line predecessors, however, they insisted on quantitative measurements and indicators of efficiency and quality results, on the introduction of systems to control the processes to improve those results, and on a detailed understanding of the flows and objectives of each operating entity.

In September of 1970 Reed moved White from his position as group controller in the Park Avenue Headquarters to the line position in the operations building downtown at 111 Wall Street as head of Area I. His charge was to run the day-to-day operations and to restructure his Area to implement the necessary management systems to achieve better cost control and quality. As one specific goal, the men agreed that their aim was to hold OPG costs flat for the period 1971 and 1972, then to allow costs to rise at a rate not to exceed 6% per year if volume warranted for 1973 to 1975.

Reed conceived of Area I, which employed 3,500 people, as a paper processing "factory."[1] He knew that to make it a well-run production unit would require revolutionary changes in attitude of the existing ranks of middle managers, changes which would further widen the cultural gap with the rest of the Bank and which would make communications and understanding even more difficult. In a Wall Street Journal article in 1975 Reed commented on his role during this period:

> I held a cultural umbrella over White's head so he wouldn't have to realize he was working in a bank. If he knew it would have scared the hell out of him. I protected him from the bankers. If we had to lay anybody off, I said, 'Do it,' and let the personnel office run up and down my back with spikes on.

Area I offered the greatest potential for savings and the greatest challenge to the introduction of change. It processed millions of items per day, and its results were highly visible. Thousands of personal and corporate checking account statements were mailed out monthly to customers of all other groups in Citicorp. Balances due from and owed to other New York banks were settled daily in a New York clearing house meeting that began promptly at 10:00 a.m. There were also strict reporting requirements from the Federal Reserve system that required that precise balances or "proofs" be kept on the DDA processing line.

White hired several young managers from outside the bank to help him understand, introduce changes and manage Area I. This team had in common a faith in a systems approach to management, a belief that it was necessary to actively "manage" their activities instead of passively "administering" them, and energy and ambition for career progress. None had extensive line experience in managing large numbers of subordinates, and few understood all the complexities of the product they manufactured. As they set to work to understand the Area I processes they imposed a new and different language on the generally older middle managers who now reported to them. In retrospect, OPG

[1]For a full documentation of the development of this conception and the results of changes in Area I during this period see the cases "First National City Bank Operating Group" (A), (A1), (B) and (B1).

management saw that an internal cultural gap was also created during this period.

By June of 1971, White's team had developed a new concept of organization for the DDA process which they saw as a necessary first step to bring the massive processing system under manageable control. Until that time all checks to be processed had been handled at input identically by a functional system regardless of whether they were to be drawn on Citibank on other banks, or whether the account was large or small. Thus, all the micro-encoder machines were together, all the proofing was done by a group of proof clerks, and so on. The new concept was to break down the input stream at the "front end" and organize the process into separate flows or "channels" according to the type of customer. In this way, each of the several channels could be managed separately and a manager held accountable for efficiency and quality of products that were visible by similar customers. During this planning White had originally attempted to involve the managers with longer experience in OPG. Meeting resistance and lack of understanding, he increasingly came to rely on his new team of managers.

After extensive planning, and flowcharting and physical renovation, all done in tops-down fashion, White pressed for the physical changes necessary to break out the front end flows. The change was introduced over a weekend in September of 1971. After a short time it was evident that there were problems. Some machines were not operating properly. Some clerks arrived at work with questions about their new assignments but found that there were not enough supervisors to answer them. Pieces of work which had been tucked away in familiar corners at the close of work on Friday could not be found on Monday. The three proof clerks who had handled three shifts of consolidated front-end operations could not keep up with the load generated by decentralized streams. The variance account, an indicator of the extent to which funds were in balance between sources and uses, hit a record high $1.5 billion two weeks after the change, before intensive weekend work by some managers brought it back to $130 million. The Citibank representative was late for the meetings with the other New York bankers for the daily exchange, and the Bank failed to file some required Federal Reserve reports.

It took two weeks to get the new processes to work, and a month before operations were under control again. It took five months to chase down the backlog of problems generated by the blowup. Despite an uproar of complaints from customers and other bank managers, however, during the height

of the problems Bob White was promoted to Senior Vice President. This was widely seen as support for his ideas and of the continuing commitment of top management to OPG change.

A year later, in September of 1972, the DDA system experienced another blowup. This occurred on the "back end" of the process, during a change aimed at providing on-line "exception" processing (stop payments, overdrafts, etc.). This blowup affected customers directly, some of whom received statements with checks missing and out of balance, but it was less serious in terms of financial impact. Corrections were instituted more quickly, and OPG recovered in less than two months.

As they reflected on the blowups, Reed and White came to believe that the problem had not been in the concept or planning of the changes themselves, but in the planning and execution of the implementation of those changes, in the way they were introduced. Other observers concluded that a major problem was the imposition of new approaches and concepts on an existing culture of middle managers who did not fully understand the changes and whose warnings were not understood by the new managers at the top.

Despite these blowups, Area I and all of OPG achieved its goal of holding operating costs flat in 1971. The same was achieved in 1972 and 1973. The total employment of Area I actually declined by 30%, from 8,300 in 1970 to 5,500 in 1973. Cost of overtime was reduced 70%. "Lost availability," or the opportunity cost of float, was reduced from $56.4 million in 1970 to $14.2 million in 1973.

In a speech before the American Banking Association in 1972, Bob White summarized how these achievements had come about and where OPG stood:

> The real achievement here is that we forecasted what we would achieve and then made it happen. Moreover, we <u>did</u> put together the kind of management team we wanted and we did get hold of the processes within our shop. At the same time, we developed a control system to measure the two facets of service to our customers: quality and timeliness. Quality measures error rate; it is the number of errors as a percentage of the total work processed on a daily basis.
>
> We currently measure 69 different quality indicators, and we are meeting the standards 87 percent of the time. When a given indicator is met or beaten consistently, we

tighten the standard; we expect to continue this process indefinitely.

Timeliness is the percentage of work processed in a given time period--generally a 24-hour time period. At the moment, we have 129 different standards for timeliness, and we expect that number to continue to grow. Today, we are meeting 85 percent of these standards. Moreover, we also continually tighten these standards as soon as we prove they can be consistently met. I think it is fair to say that our service performance has improved greatly since we began to hold costs flat --if for no other reason than we now really know what we are doing.

Closing the Cultural Gaps, 1972-1974

Although in 1972 White and Reed could point to clear improvements in control of costs and efficiency, there were symptoms of continuing problems both within OPG and in relation to the banking groups. Internally, much of the attitude and language of the new breed of managers had not rubbed off on middle management. There was a lack of enthusiasm and responsiveness. In the Spring of 1972 there was a union organizing drive among clerical workers at 111 Wall Street. Although it did not succeed, Reed and White were concerned that low level line managers might not be representing an accurate picture of their intention to create a stable as well as productive work environment.

Externally there was continual sniping and misunderstanding with several banking groups. Because of the tighter management and continuing change in OPG the old informal channels of communication with banking groups had been closed off. From the perspective of OPG, a minor operational problem would get exaggerated out of proportion and pushed up to senior levels, where it would be used as evidence against the changes being made in OPG. Proud of its achievement in improving its cost and timeliness results, OPG management would present their numbers to senior managers only to have them respond that complaints from key customers about service were increasing. As one OPG manager described it in 1975:

> We would show them our charts and statistics on costs, quality and timeliness and how we were improving. They would say 'Those are lies. The numbers don't mean

> anything. The costs to us of services are rising. Besides, we don't deal in averages, we deal in customers. You may get 95% perfect, but if a big corporate customer is one of the 5%, it's a disaster for us.'

In late 1972 and early 1973 Reed and White took steps to begin to lower the "cultural umbrella" around OPG. It was judged that OPG was now strong enough to withstand whatever shocks might result, and that further isolation could be dysfunctional to the Bank as a whole. Two new officers were hired for White's staff. Richard Matteis was told to study the problem of "external integration" and Arthur Kirsch to study "internal integration." As Kirsch later explained it:

> What we were supposed to do was not entirely clear. There I was, with no one working under me, trying to define a problem that could be solved to improve the climate within OPG. I spent five months writing papers and talking to a lot of people, especially White, and gradually some handles began to emerge...

After a short time Matteis was given a small staff and the job of conducting monthly meetings with senior officers in what later became the National Banking Group. These monthly management review (MMR) meetings were aimed at achieving mutual understanding of OPG's measures of results and the others' problems with OPG services. Later, this type of meeting was extended downward to include lower level managers in both groups. In 1973 Matteis was given responsibility for the corporate market "product management" group, a unit which was transferred from the corporate banking group. OPG initiated a series of newsletters and bulletins designed to acquaint account managers and service assistants with the people, organizations and functions within OPG.

Art Kirsch was given responsibility for personnel in OPG. Although strictly speaking a "staff" position in OPG, Kirsch had reporting to him personnel officers in each of the OPG Areas at Wall Street. He began to institute new approaches for management by objectives and performance appraisal. A significant innovation was the introduction of an additional level of management to the existing five levels between clerical and Group Head. These new line managers were primarily responsible for the

implementation of change, including making certain that problems foreseen by the lower managers were made clear to the higher line and staff.

During 1973 White was given responsibility over all the OPG production operations when Larry Small, who had successfully introduced changes in Area II and Area IV, was promoted into a new position in the NYBG.[1] With these additional responsibilities, White was in a position to plan for organizational changes across the entire OPG which would represent the next phase of closing the external gap and reintegrating OPG into the Bank.

PROJECT PARADISE AND ITS IMPLEMENTATION

White was officially made head of OPG in July of 1974 when John Reed moved up to work on worldwide consumer marketing for Citicorp. During the very next week Project Paradise was announced.

Art Kirsch, who moved to head White's GMO staff in 1975, explained the meaning of the name "Project Paradise":

> I wrote a paper which described the feelings of first line managers at 111 Wall Street. I suggested that these managers were alienated and felt they were in 'hell or purgatory', forgotten by the bank and seeing no escape from their concerns. The feeling went back to 1968 when they were initially separated from the rest of the bank and continued through all subsequent changes. At least one objective of Project Paradise is to bridge the gap between OPG and the marketing groups and give our people the feeling of being an accepted part of the bank again. Compared to where they've been, that will be Paradise!
>
> OPG has used a lot of negative reinforcement. Bob really cracked down on or moved out people who weren't performing. Negative reinforcement creates quick learning and performance which was appropriate to the task

[1] In 1974 Small became the head of personnel of Citicorp. Following him into other positions of high responsibility throughout the Bank were to be a number of the "new breed" of successful OPG managers. In fact, OPG became a new supplier of management talent to the Bank. In 1975 it was found necessary in OPG to restrict the outflow for fear of decimating its own supply of management talent.

of achieving substantial change in a short time frame. We're changing our image, organization and style of management. Now there is more positive reinforcement.

In a discussion draft document to his senior staff dated March 15, 1974, White provided the basic rationale for Project Paradise:

> We believe the importance of our contribution (efficiency) has been understood by top management, but because our approach has been counter to the conventional wisdom that says 'you have to spend money to provide good service' and because it has had negative impact on the security of people and because it has stretched some of the bank's heritage and bruised its culture, it has been misunderstood or unappreciated by the rest of the bank.
>
> We believe we have built an infrastructure of management, processes, procedures, and systems that will continue to achieve optimum operational efficiency for the next five to seven years. This is a machine intensive operation that will keep costs flat by being on the computer learning curve rather than on the labor intensive 6-8% a year automatic cost increase curve.
>
> We now want to change the thrust of our strategy to one of effectiveness in Institutional Service rather than efficiency in Operations. We have hired and trained the right people, developed the management disciplines and procedures to provide better support to the marketing groups. The key is to move away from our posture of planning and producing average products for an average customer.
>
> Additionally we would now like to provide increased employment security for our staff to provide them with the atmosphere they need to help us positively implement the new systems and organization. Although few people have actually left the bank as a result of layoffs or firing, the continuing possibility has kept our staff tense and less receptive to change than if we had a full employment policy.

White later elaborated on why he was willing to turn over or share with other groups the management of operations:

I'm trying to structure OPG so that the banking groups can take over their service functions if they have the inclination and management expertise necessary. Right now the profit potential on the services side is small and the banking groups should be concerned primarily with their credit business. In the long run, however, the profit potential on the services side is enormous but it will be a different business than the one we have now.

What I want to do is to finish facing-off my service operations with the banking groups. This will give me a customer base. Then I want to get the terminals and systems into the corporate treasurer's office. The terminal will do a full DDA accounting service and money transfer. Then I want to start doing all his back office work. He has the same problems I had, and we can do that job better today than almost anyone else. We've started this in a way. We've taken over Korvette's customer credit operation. The potential for services is unlimited.

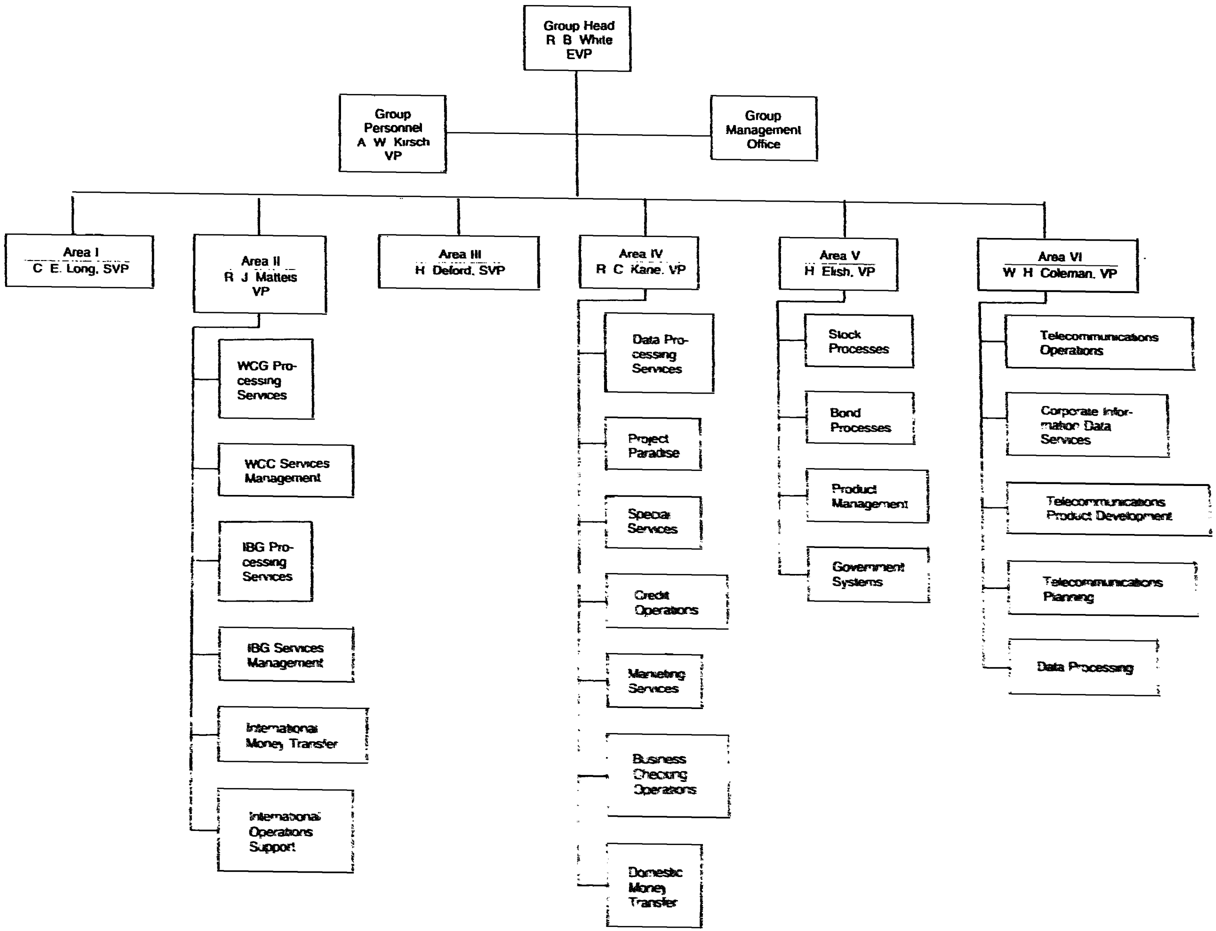
By the end of 1974 the thrust of Project Paradise was becoming reflected in the OPG organization chart (Exhibit 3). Area I under Charles Long was relatively less affected, as it already served primarily the retail and commercial customers of the NYBG. Area II, then headed by Dick Matteis, was to become the recipient of corporate services for the World Corporate Group and the International Banking Group, most of which were still being handled in Area IV, under Dick Kane. Ultimately, Kane would retain only those services corresponding to the National Banking Group.

There were two Areas which would not be faced off, Area III, General Services (Hal Deford), and Area VI (Wade Coleman). Area VI was deeply involved in "Project Mustang," the project which would enable corporate customers of the Bank to bypass much of the paperwork involved in transactions by having a computer terminal in corporate treasurers' offices. Statements of balances, transfers, and most other typical transactions could be handled directly and instantly by electronic transaction and computer. To the extent it was successful, the system could substantially reduce the cost of transaction processing and error rates while providing the customer more timely information on his resource position. However, income from the system was to be from fees rather than the interest earned by

Exhibit 3

PROJECT PARADISE

Partial Organization Chart--OPG, December 1974



requiring minimum balances. By reducing the levels of balances required of customers the Bank would eventually have to seek new ways of raising capital to cover reserve requirements and loan demand. The full development of this system was to be "the banking of the future" and a means by which OPG could establish a mechanism for selling many services to corporate customers.

Regarding the role of Project Mustang in the evolution of OPG, Art Kirsch commented:

> The ultimate integration of operations into the Bank is through technology. We can all go back to being bankers and eliminate operations as a specialization. Bob believes we're on the threshold of putting the specialization or knowledge of how to perform transaction processing into the computer and putting the data entry function as close to the customer as possible--right in their offices.

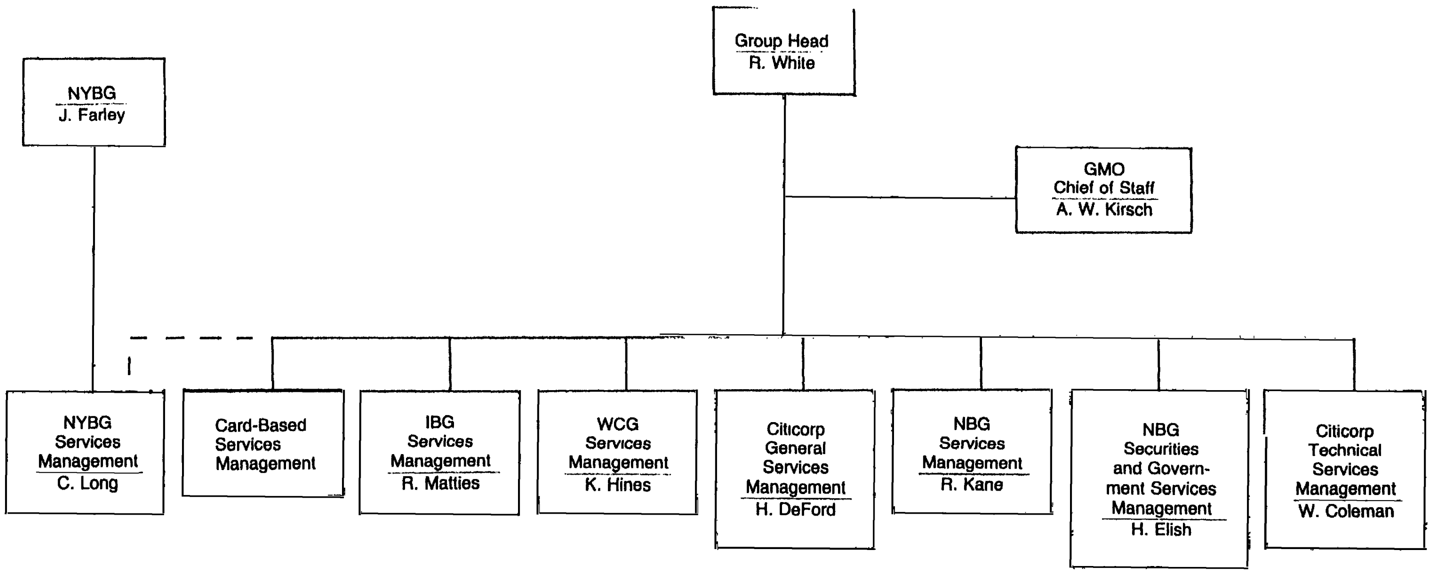
The intended organization chart for OPG for later in 1975 is shown in Exhibit 4. In February, in a memo sent out jointly by White and James Farley it was announced that Area I was being transferred to NYBG under Farley, with White retaining a "matrix" responsiblity over it.

The Paradise Plan within OPG

When Bob White had taken over the old Area I (DDA) he changed what had been a functional organization in which all the work flowed into one large pipeline of processing functions into one which was broken down into several smaller lines. Each of these lines (channels) carried a product for a different customer, and each could be supervised by a single manager who controlled almost every aspect of his process. After taking over the entire production base of OPG, White found it was necessary to have his newly acquired production areas "channelize" their operations before he could fully implement adequate control and accountability systems, and before he could start Project Paradise. He reflected on this process:

> We channelized those operations and didn't blow them up. It's getting to be old hat. What's really important though is the story told by comparing performances. The old Area I--DDA--that I channelized in

Exhibit 4
PROJECT PARADISE
Partial Organization Chart--OPG, May 1975



1971 just keeps getting better. We bit the bullet and bled hard and fast. Now it just gets better and better. The operations that weren't channelized in 1971 still haven't worked out all their problems.

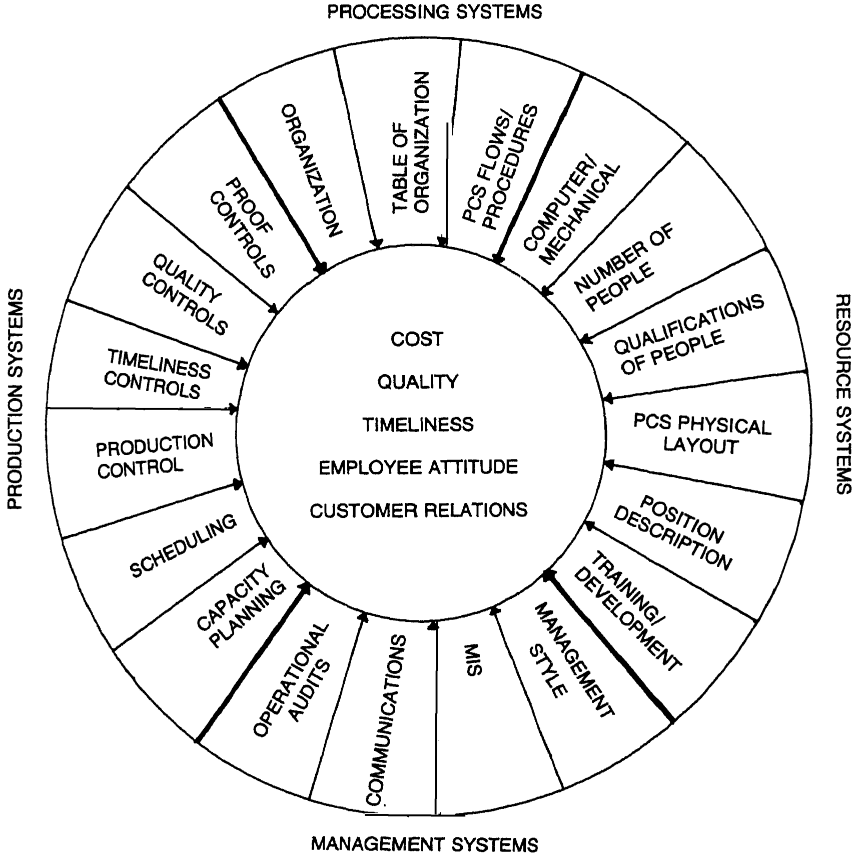
The initial plan for implementing Project Paradise consisted of three phases. Phase one was to be a study of all 27 of the OPG channels by special teams. Four teams were created, each consisting of individuals with proven skills in planning OPG organizational changes and at least one individual with line experience in managing channels. Team members were predominately "staff" personnel, however. The entire phase was known as the "Staff Study Phase" and was headed up by Wade Coleman, who at that time was head of GMO staff. The objective of phase one was to study and divide the processing work done by each channel into three parts: that which pertained to IBG customers, that for WCG customers, and the "residual." Then, on paper, the study would estimate what additional manpower and machines would be required if each piece was moved into the new face off organizations. The study would result in a notebook for each channel, and summaries of estimates of the volumes and resources required to accomplish the reorganizations. As they studied each channel, the study teams were to be guided by the checklist of "processes and results" which had originated with White and had evolved over the years into the basic model for management in OPG. The elements of this model were given in Exhibit 5.)

Phase two was planned as the "vertical breakout." Using the phase one studies, line managers assisted by staff officers would plan and conduct the actual physical separation of channels in place. That is, new equipment and people would be brought in if necessary, but the breakouts would remain under the line managers who had been responsible for them. All the bugs were to be ironed out under those managers' responsiblities.

Phase three was to be the "horizontal breakout" in which smoothly running channels for WCG, IBG and other customers were physically moved to separate floors. Line responsibilities would then fall to managers in each of the new face off organizations.

Very early in the process White made it clear that he expected there to be no additional expenses or investments due to Project Paradise changes. Any necessary incremental costs were to be covered from new savings achieved during

Exhibit 5
PROJECT PARADISE
The Management Model: Results/Processes



WE MANAGE

- Within 4 systems
- Under 19 disciplines
- For 5 results

TO MAKE THINGS HAPPEN

the same period. OPG managers knew from the outset that they would have to conduct the Paradise reorganization while at the same time striving for the usual stringent budget targets. Achieving these targets involved results improvement projects such as the automation of channels and reorganization quite apart from Project Paradise. Moreover, these managers knew that their MBO objectives were based in part on achieving these savings and other results targets. The degree to which objectives were met, missed or exceeded became the primary determinant of a year-end ranking of all managers. A manager's position in this rating list determined directly the amount of merit increase in salary he would receive. In addition, the rating list was used to help decide who should get bonuses and how much they should be. Thus, if a manager simply met all his objectives he would not be ranked as high as those who exceeded theirs, and would likely receive less of a raise and bonus than they. By basing ratings and compensation on a curve the system was intended to encourage a healthy competitiveness among managers and reduce the likelihood that a manager would meet his objectives early in the year and then "coast."

Although the MBO system provided a clear statement of what was expected of a manager, many managers in OPG felt that Bob White's personal style was to be deliberately ambiguous, and to give different or conflicting signals to different managers. While they believed this was painful at times, on the whole they thought it was effective. They saw tension and positive conflict being created by White's insistence to some to maintain schedule and budget, while others were told to proceed carefully and to watch out for blowups. At the outset of Project Paradise White commented on this observation and on his experience in building the OPG organization:

> I may give different signals unconsciously in the sense that I think each manager's understanding of his world and his background and the management language that he is familiar with might be different. For the people that have experienced the blowups I don't need to remind them to be careful and touch all bases. The others that have only heard about those episodes I probably think need understanding of the processes emphasized rather than schedule and speed.
>
> It's incredible how long it takes to build an or-

> ganization. We had to build up both the people and the information necessary to even think about a Project Paradise. We have people available now who know how to change this organization who didn't know before, and we have information we didn't have before. We've developed the ability to communicate and this is really an important change. We have a common language system, and that management model is in everybody's mind, down to a certain level in the organization. All the people reporting to me are "my people"; they are all hand picked and know they are part of the team. After you go down a few levels that distinction starts to cloud. It's a difficult and time consuming process in a big organization to transmit your beliefs down through the managerial layers to the people on the processing line.

Actual Paradise Implementation

The phase one studies began on time and were completed within the scheduled three weeks. Coleman and his teams worked exceptionally long days, with what was seen as enthusiasm and thoroughness. One team member recalled White's reaction when the 27 volumes, one for each OPG channel, were presented to him:

> White said that he usually wasn't surprised with the work that people produced because in the past everyone had really come through to give him what he wanted. This time he said, 'I'm really impressed.' I've known him now for over 3 years and I've never seen him give a compliment like that.

As phase two got under way, however, a problem arose. Some of Coleman's staff team members actually began arranging for physical changes. This came to light in September, 1974, when Art Kirsch received a call from one of his personnel officers at 111 Wall Street. Kirsch explained what happened:

> The staff was actually implementing changes. One of the team guys was furiously racing around making space allocations and telling my people to get ready to move. This was supposed to be a staff study and all of a sudden I'm getting requests for office construction!

I thought the implementation was premature, especially without the line involved. I was scared and went to see Wade Coleman. I told him it would be a disaster, but I didn't get anywhere. Wade had not been through the Area I blowups before, and moreover this was Area IV. You can really lose money faster in international money transfer than you can by blowing up DDA. With DDA the paperwork is around, you just have to find it. In IMT you could lose track of millions of dollars in the international transfer system and never locate it.

Well, I and a number of line managers blew the whistle. We had a big meeting with Bob to review the whole situation. He questioned us very closely and got a good understanding of what was happening. He slowed it down.

The next day when I came to work I found a little printed sign on my door that read, "A SHADOW IN PARADISE."

As a result of White's involvement in phase two it was formally announced for the first time that Dick Kane, head of Area IV, would be responsible for the implementation of Paradise through phases two and three.

Phase two proceeded with the decision to physically break out the WCG pieces from each channel first, then proceed to the IBG. At about this time, however, White had a luncheon meeting with George Vojta, head of IBG, to explain the Project Paradise concept. As a result, White switched the priority, telling his managers to work on the IBG pieces first. In October 1974, White explained what had occurred:

George Vojta wanted to get all non direct customer contact activities out of his staff and concentrate solely on the customer field contact side of the business. He thought that this would be a great opportunity to do it. He will transfer almost 80 people to OPG and be left with no service activity.

I thought it was opportune also since it was consistent with what I was trying to do. By getting all the service into OPG, we can reorganize the total aspect of the support business to face off to the banking side of IBG.

As phase two got under way, a new issue emerged. Despite the fact that line managers had "signed off" on the phase one studies and had given their agreement to the breakouts and schedules for change, there seemed to be resistance when the actual changes began. One of the staff members who was ultimately to take line responsibility over several channels in the IBG face off described this as follows:

> It became clear we were not getting the support of line management in making these changes. They had signed off on the books that everything was in order but we still didn't get any cooperation. This happened in September, three-quarters of the way through the year and they had their goals and objectives for the year to meet. Then we came along and said that we wanted to change their world. Certain cost savings projects had to be shelved, others postponed, and so on.

A line manager saw the situation this way:

> I was just getting rolling with a big automation job in my channel, a project which had just been approved by my boss, when these guys from uptown come in with their notebooks. I ask them, 'Where are you going to get the money to split out this channel?' and they say, 'From your automation project.' Like hell they are...

Bob White's summary of this issue in October 1974 was the following:

> Up until the time we started to split out the IBG pieces the whole project had been planning. Now we were ready to do it, but the line managers weren't. What happened was that the line people knew the study was going on because they all agreed to it--but they forgot about it while the study teams were in operation. We were ready to move and everyone in the line wanted to know what was happening. They just didn't keep on top of it.
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> Coleman really couldn't implement the project in Kane's shop. The implementation really has to be done by the line, but the line can't do the initial study because they don't have the time or resources.
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> So we had to go through another stage of handing

responsibility from the planning unit to another implementation unit. What seems to happen is that you plan what you're going to do and how to do it, and then start all over again planning, organizing, directing, and controlling the implementation with a different group of people.

Ideally you would like to keep up the intensity. Some people worked very hard for 3 or 4 weeks and got sick and took vacation because of the intensity. There has been a let down and it has probably cost us a couple of months.

The Situation in March 1975

As a result of these problems, the implementation of the planned changes was delayed. Where the original schedule called for the completion of the IBG breakout by January 31, 1975, in February it had been reset to April first.

Then, in March, Bob White learned about the potential slip in the deadline for the phase three transfer of several channels from Area IV to Area II, where the new IBG Services Organization was taking shape. White knew the transfers of responsibility in Project Paradise had taken their toll in terms of time, and that some slippage in the schedule had had to occur. The high degree of commitment and enthusiasm that characterized the study phase had appeared to wane as the leadership had shifted to the line. White had sensed the change of pace but felt now that some of it was probably inevitable. He also knew the line managers were getting extremely careful about receiving channels into the new organization, not wanting to be in charge if a blowup occurred.

Even though it was early in the year, there had already been a number of arguments over how much the receiving manager was to take of the responsibility for 1975 results improvement projects. With the Area IV line managers busy with phase two breakouts as well as day-to-day operations they argued it was unfair to charge them with a monthly proportion of targeted annual goals. The receiving managers argued they should not be expected to make up more than at most a time-proportioned part of the targets. All the while, it was important that IBG Services be established and running smoothly when the transfer of Vojta's 80 customer service people took place. If there was net delay beyond April first, that arrangement might have to be changed.

Reflecting back on the evolution and planned change of OPG, White attached great importance to Project Paradise. Ironically, some of the very reasons for it to be possible to reintegrate operations into the Bank, namely the tight control system, finely tuned and efficiently running operations and motivated managers, now seemed to be blocking the way. He wanted to resolve problems of schedule slips, budget and target attainment and potential blowups in ways which would be consistent with the management control systems and management practices in OPG, would not impose unreasonable burdens on his people and would insure that Paradise was completed.

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